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Table of Contents

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The Economics of Pharmaceuticals in Central and Eastern Europe: A Focus on Generics, Research, and Development

Steven J. Szydlowski and Robert Babela

***Abstract*—**The cost of health care delivery continues to increase at alarming levels in the world. Public health departments, health institutions, government agencies, and other key health stakeholders continue to work towards controlling and minimizing costs of care while increasing access and quality. A major contributor driving the cost of health care is pharmaceutical expenditures among others such as technological advances and uncoordinated care. The following article reviews health economic considerations as they relate to health system capacity to provide efficient and low cost care. The authors focus on economic implications for the pharmaceutical industry in Central and Eastern Europe.

***Keywords*—**Economics, health care delivery, pharmaceuticals, markets

I. Introduction

HEALTH care services and products provide a significant portion of a country's Gross Domestic Product (GDP). The economics of health in a given country infuse many factors contributing to the public good such as workforce employment, medical supplies and device development, and the social good of health that improves productivity of citizens. The health care industry is complex in that business practices and financial sustainability of organizations is dependent on community health status, provision of care, scarce resources, a multi-disciplinary, diverse skilled and unskilled labor force, and patient satisfaction. According to the World Bank (2014), the percentage of GDP for several countries in Central and Eastern Europe is below.

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	2010	2011	2012
Czech Republic	7.4	7.5	7.7
Hungary	8.0	7.9	7.8
Poland	7.0	6.8	6.7
Slovak Republic	9.0	7.9	7.8

As part of the health care expenditures in a country contributing to rapid increases in cost are pharmaceuticals. According to the World Health Organization (2014) the global pharmaceuticals market is estimated at $300 billion dollars a year with anticipated increases to $400 billion in three years. Of this market, the ten largest drug companies control over a third of share with profit in many cases of thirty percent (World Health Organization, 2014). Herman (2014) identifies nine major factors that are impacting the health economic including:

- Physician, facility, and drug costs
- Expensive technologies and procedures
- Fragment and uncoordinated care
- Lack of cost consideration from patients
- Fee for service
- High administrative costs
- Unhealthy behaviors
- Expensive end of life care
- Provider consolidation

This paper focuses on the drug costs considerations as it relates to health care in CEE and reviews the role generics, research, and development has on the economy.

II. HEALTHCARE ENVIRONMENT IN EUROPE AND CENTRAL AND EASTERN EUROPE

The challenges facing CEE can be categorized in three categories: financial crisis, economic crisis, and sovereign debts crisis (EFPIA: CEE TF. Brussel, 2011). The implications for patients as a result are several. Europe's perspective on healthcare risks is changing. Health outcomes become increasingly irrelevant in the face of budgetary

pressure. International organizations, ie. Organization for Economic Co-operation and Development, have become much more influential in decision making around healthcare, but focusing narrowly on reducing spending. These considerations often do not take into account the potential harmful effects of these cuts to patients. Stronger cooperation among national health authorities within Europe and higher risk of spillover effects from one country to another, or from one country to the European level, of policies that damage patients access to innovative treatments and increase health inequalities. Within this healthcare environment, opportunities tied to demographic changes are displayed. From 2007 to 2050, the European average age is projected to increase from 38.9 years of age to 47.3 years of age with those over 65 years of age increasing from 16 % of the population to 28 % of the population complimented by an increased life expectancy from 76 years to 82 years (BIPD, 2008).

Two major dilemma exists within the healthcare environment. The first, healthcare as a strategic investment for the future has been an ongoing debate in particular as it related to the demographic changes. The intention to improve healthcare delivery in order to maintain a health labor force in growing economies is critical. This has been a high priority in all political decisions. The second, to consider healthcare as a "consumption" item during the budgeting process and reduce spending. Cost often becomes a more important factor than better health outcomes.

III. ECONOMIC AND MARKET DYNAMICS

The economic evolution and market varies from CEE countries. According to IMF (2011), the crisis had differential impact with slow decline in 2012 with the exception of Slovakia of 3.3% of GDP at constant prices. Both Hungary 1.8% to 1.7% and Poland 3.8% to 2.9% saw decreases in GDP growth at constant prices. It is important to note the 2009 health significant losses of GDP growth for Slovakia and Hungary, while Poland showed positive growth of 1.6% (IMF, 2011). The annual growth rate in 2010 for Slovakia and Poland were less 2010 compared to 2008, while Czech had no variance, and Hungary saw slight increases.

The CEE market overview for pharmaceutical innovative market value evolution realized steady increases from 2009 ($9.49 billion USD) to 2013 ($11.70 billion USD). Generic market value evolution also saw increases from 2009 ($10 billion USD) to 2013 ($13.1 billion USD). The rate of increase in generic market value over the innovative market was significant over this period of time.

In the Czech Republic, temporary reimbursement for highly innovative medicines was present. Electronic auction utilizing transparent methodology and procedures was emphasized. The Czech Republic referenced the "Pharmo-economics Regiser" to support accountability and transparency. In 2010, a market-wide 7% cut in drug prices and reimbursement reductions were in effect (Stefancyn, M. et al, 2011). The authors further reported the generic drug market developed as a rate or around 12% in 2010 and developed at a slower rate between 6-8% from 2011-2013. The growth rate of the innovative medicine market to slow around 4-6%.

In Poland, access to pharmaceutical innovations had been significantly insufficient. This remains one of the major challenges for the country's health care system. The growth of innovative markets was modest between 2011 – 2013. In 2010, generics controlled 75% of the total market (Stefancyk, M. et al, 2011).

Less than 1% of Hungary's GDP is spent on pharmaceutical research and development each year (Stefancyk, M. et al, 2011). The Hungarian system uses the reference pricing system which prescribes cost effective therapies with generic rather than brand names. Because of the country's difficult economic situation, rapid growth on the pharmaceutical market will not be possible in the next few years in Hungary.

The expected growth rate of generic medicine in Slovakia will continue to exceed that of their counterparts through 2014. As a result of reference pricing rounds, the price of several hundred medicines have been reduced with many of them being innovative medicines. There is more generic market support rather than innovative. A new reference pricing system has been in place in which drug prices are set at the second lowest price in a basket of prices of all European Union countries. This lead to increases in the generic prescriptions instead of brand names. Slovakia is the most promising country for generic market growth with an estimated 9-11% growth compared to Hungary, Poland, and Czech Republic with 5-6% growth (Stefancyk, M. et. Al, 2011).

The compound annual growth rate (CAGR) in Czech and Slovak Republics was estimated at 5% through 2013 and 2-3% in Hungary and Poland during the same time (SAFS, 2011). The development of these markets can be threatened due to the economic crisis and effects from 2009-2010 and continual restrictive measures from the Ministries of Health and governing authorities. A high risk of parallel export and import of product also poses a threat.

IV. ECONOMIC AND MARKETING IMPLICATIONS FOR PHARMACEUTICAL INDUSTRY

The economic and marketing implications for the generic pharmaceutical industry in CEE is significant. The strategy to present first on the market, keep competitive prices, and patient co-payments low in comparison to other generic competitors is critical. A strong business development model with at least four to six new launches each year can support this model. As for research and innovation, the protection of patents and belief in established brands is essential. Price flexibility and providing discounts for wholesalers can serve as effective strategic practices. Industry leaders should re-think current business models to have a more efficient and low cost pharmaceutical model is critical to include product line extensions.

V. CONCLUSION

There is a great opportunity for generic drug market development as part of GDP for health care expenditures and

to support lower costs products. The rising costs of health care globally, specifically pharmaceuticals, have raised concern for health economics and health system leaders. With a focus on low cost, effective prescription drug usage, pharmaceutical leaders can bridge the need for market growth and while offering lower cost products to patients and payers.

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Modeling the Value at Risk (VaR) of Energy Commodities Futures Using Extreme Value Copulas

Xue Gong and Songsak Sriboonchitta

***Abstract*—** This study use the Extreme Value Copula to construct the joint distribution, which is adopted to estimate Value at Risk (VaR) of a portfolio consisting of the crude oil and natural gas commodities futures. When the VaR estimation focus on modelling extreme values, i.e., the tails of the distribution, the extreme value copula may be a good choice, since it considers max-stable distributions and give certain restrictions on the copulas. The heavy tail distribution has been found in crude oil margin and the thin tail is detected in natural gas margin. Moreover, we estimate VaR of the underlying portfolio at 90% and 95% by out of sample forecasting. According to the results of backtesting, we compare the out-of-sample forecasting performance of VaR by several extreme value copulas and benchmark method. The results show that the extreme value copulas have out-of-sample forecasts than the benchmark one.

***Keywords*:** Extreme value copula, Value at Risk, Energy commodity futures, Risk management.

I. Introduction

THE copula method has been used widely in modelling the dependence of the financial assets. In the application, the most interested part is to model the largest expected loss, i.e. the extreme value in the market; therefore the extreme value copula which is used as a tail dependence modelling may be a good choice.

Value at Risk (VaR) is one of most widely used measures in financial risk management. This measure gives a threshold loss such that the probability that the loss on the portfolio over the given time horizon exceeds this value is p. The advantage of VaR is that it reduces the risk to just one single number (Jorion, 2007). It is simple and also useful. There are many methods to estimate the VaR, but they are mainly categorized in three groups: (1) parametric method, (2) non-parametric method and also (3) semi-parametric method. The method we introduce here is the parametric method, which makes specific distributional assumptions on returns, i.e., the extreme value distribution and then calculates the corresponding VaRs.

Moreover, the commodity futures, such as the energy futures always exhibit heavy-tailed. As we known, the financial asset returns has two kinds of non-normal features the joint distribution and the distribution of margin, both of them exhibit the heavy tail and extreme tail dependence. The characteristic of the extreme movement can be captured by different models (Bastianin, 2009 [1]). The alternative distributions are student t distribution, which focuses on the heavy tail, or skewed student t distribution, which focuses on skewness and heavy tail (As Lu, Lai, and Liang, 2011 [2]). However, in this study we select the extreme value approach since it models directly on the tails of the distribution, and more flexible than the student t distribution or skewness t distribution. Moreover, the extreme value copulas are the copulas which can connect the component-maxima margins. It could be a promising approach to model the VaR of portfolio.

In our study, we use the extreme value copula with component maxima margins to estimate VaR of a portfolio which consist of crude oil futures and natural gas futures traded on the New York Mercantile Exchange (NYMEX). Since the relationship between the oil and natural gas is interacted, it is interesting and meaningful to investigate the dependence of them. The main objective is to investigate the VaR of the diversification portfolio consisting of two energy commodities.

The rest of the study is organized as follows. Section 2 introduces the theory of copulas and extreme value copula modelling. Section 3 illustrates how to use copulas to model VaR by out-of-sample forecasts. Empirical results are presented in Sect. 4. Section 5 concludes.

II. Extreme Value Copula

A. Copulas

Copula is a useful tool to link univariate distribution functions to a multivariate probability distribution. Copulas are used widely in financial risk management, especially in credit scoring, derivative pricing, and portfolio selection (Rootzén, and Tajvidi, 1997 [3]; Poon., Rockinger, and Tawn, 2004[4]).

A two-dimensional copula is a distribution function $[0, 1]^2$ with standard uniform marginal distributions. The copula for every $(u_1, u_2) \in [0,1]^2$ can be expressed as

$$\begin{aligned} C(u_1,u_2) &= P[F_1(X_1) \le u_1, F_2(X_2) \le u_2] \\ &= P[X_1 \le F_1^{-1}(u_1), X_2 \le F_2^{-1}(u_2)] \\ &= F[F_1^{-1}(u_1), F_2^{-1}(u_2)] \end{aligned} \quad (1)$$

Theorem (Sklar 1959 [5]). Let F be a joint distribution function with margins $F_1, \ldots, F_d$. Then there exists a copula C: $[0, 1]^2 \rightarrow [0, 1]$ such that, for x_1 and x_2,

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$$F(x_1, x_2) = C(F_1(x_1), F_2(x_2)) \quad (2)$$

If F_1 and F_2 are both continuous, then C is uniquely defined.

This theorem implies that every multivariate distribution has and only has one copula, and the combination of copulas with univariate distribution function can be used to obtain multivariate distribution functions (Gudendorf, and Segers, 2010 [6]; Cebrian, Denuit, and Lambert, 2003 [7]).

B. The Extreme Value Copulas

The commodities futures suffered the extreme co-movement, especially in the energy futures since the crude oil and natural gas are substitutes and also complements in consumption and production. When the demand or supply is tight (loose), the price will shoot high (low) together. Therefore, it is reasonable to study these two futures by extreme value Copula. They are one kind of copulas, which are the possible limits of copulas of component-wise maxima of i.i.d. samples.

Consider two series of component-wise maxima:

$$M_n = \max(X_1, ..., X_n) \quad (3)$$

$$N_n = \max(Y_1, ..., Y_n) \quad (4)$$

Assume that the pairs (X_i, Y_i) are independent and that their common bivariate distribution function is H with marginal distribution functions F_1 and F_2 as in (1). Then the distribution functions of M_n and N_n are:

$$\Pr(M_n \le x) = F^n(x) \quad (5)$$

$$\Pr(N_n \le y) = G^n(y) \quad (6)$$

The joint distribution of two series is:

$$\Pr[M_n \le x, N_n \le y] = H^n(x, y) \quad (7)$$

The extreme value copula has the maxima-stable property, which said that from the extreme value (maxima) we can derive the whole joint distribution.

C. The Pickands dependence function

A copula C is called as an extreme-value copula where there is a real-valued function A on the interval [0, 1] such that

$$C(u, v) = \exp\left\{\log(uv) A\left(\frac{\log(v)}{\log(uv)}\right)\right\} \quad (8)$$

for $0 < u, v < 1$, $A: [0,1] \to [1/2, 1]$ is convex and satisfies $k \vee (1-k) \le A(k) \le 1$ for all $k \in [0,1]$ (Gudendorf, and Segers, 2010 [6]). Specially, $A(0) = A(1) = 1$.

D. The extreme value copula families

There are several extreme value copulas, they are:

Gumbel copula

The dependence function is

$$A(w) = [(1-w)^r + w^r]^{1/r}$$

with $r \ge 1$. The corresponding copula function is given by

$$C(u_1, u_2) = \exp\left\{-[(-\ln u_1)^r + (-\ln u_2)^r]^{1/r}\right\} \quad (9)$$

when r=1, it means independence, when $r = \infty$, it approaches to complete dependence.

Husler-Reiss (HR) copula

the HR copula has following corresponding distribution:

$$C(u_1, u_2) = \exp\left\{\Phi\left[\frac{a}{2} + \frac{1}{a}\ln\left(\frac{\ln u_2}{\ln u_1}\right)\right]\ln u_1 + \Phi\left[\frac{a}{2} + \frac{1}{a}\ln\left(\frac{\ln u_1}{\ln u_2}\right)\right]\ln u_2\right\} \quad (10)$$

where Φ is the standard normal cumulative distribution function.

Galambos copula (negative logistic model)

The dependence function:

$$A(t) = 1 - \{t^{-1/\theta} + (1-t)^{-1/\theta}\}^{-\theta}$$

and the corresponding distribution is

$$C(u_1, u_2) = u_1 u_2 \exp\left\{-\left((-\log u_1)^{-\theta} + (-\log u_2)^{-\theta}\right)^{-1/\theta}\right\} \quad (11)$$

where $\theta > 0$.

E. The estimation problem

There are two steps to estimate the extreme value copulas (Larsson, 2010 [8]):

Step one: to estimate the marginal distribution function F_n and G_n of M_n and N_n.

Step two: to estimate the copula C_n.

F. The goodness of fit test for the copula

To choose an appropriate copula is critical (Durrleman, et al., 2000 [9]; Liu and Sriboonchitta, 2013 [10]). One of methods is to find the copula which is to minimize the distance between the empirical copula and the proposed copula. Another criterion is to measure AIC and BIC. The last one we introduced here is the goodness of fit (GOF) tests (Genest et al., 2009 [11]). Although there are many kinds of GOF tests, we will use the Cramérvon Mises (CVM) statistic which is simple and also powerful.

$$S_n = \sum_{t=1}^{n}\left\{C_k(u_t, v_t; \hat{k}) - C_n(u_t, v_t)\right\}^2 \quad (12)$$

This measures the distance between the fitted copula $C_k(u_t, v_t; \hat{k})$ and the empirical copula Cn.

G. The multivariate VaR of the portfolio

The VaR of the univariate asset is actually a quantile. The definition is as follows (Embrechts and Puccetti, 2006 [12]):

For $\alpha \in [0,1]$, at probability level α for a random variable Y, that is.

$$VaR_\alpha(Y) = \inf\{x \in \mathbb{R} : G(x) \ge \alpha\} \quad (13)$$

It should be noted that when G is strictly increasing function, $VaR_\alpha(Y)$ is the unique threshold t at which $G(t) = \alpha$. However, with the multivariate marginal, there are infinite vectors $s \in \mathbb{R}^k$ at which $G(s) = \alpha$. Therefore, the multivariate VaR at probability level α for an increasing function G is a set:

$$VaR_\alpha(G) = \partial\{x \in \mathbb{R}^k : G(x) \ge \alpha\} \quad (14)$$

According to Denuit (1999) [13], the VaR associate with S = X_1+ X_2 will lie within the bounds:

$$VaR_\alpha(G) = \partial\{(X_1, X_2) \in \mathbb{R}^2 : G(X_1 + X_2) \ge \alpha\} \quad (15)$$

$$\partial\{G(X_1 + X_2^*) \ge \alpha\} \le \partial\{G(X_1 + X_2) \ge \alpha\} \le \partial\{G(X_1 + X_2^{**}) \ge \alpha\} \quad (16)$$

The aggregate risks in which the variable X_2^* and X_2^{**} are

both distributed as X_2 but are respectively in perfect negative and positive dependence with X_1 via the relation:

$X_2^* = F_2^{-1}\{1-F_1(X_1)\}$, $X_2^{**} = F_2^{-1}\{F_1(X_1)\}$

where Fi is the distribution function of Xi and

$F_i^{-1}(t) = \inf\{s \in \square : F_1(s) \geq t\}, \quad i = 1, 2$

It is obvious that the VaR lies in the boundary of totally dependent and totally independent case, the value depends on the dependence degree of two assets.

III. Empirical Study

A. Data Description

We examine the VaR of the portfolio of two commodities futures: crude oil and natural gas futures traded on the NYMEX. The weekly closing futures prices are collected, which is covering the period of January 7, 2005 to January 2, 2015, totally 552 observations, 11 years. The data are sourced from Datastream. The percentage returns are adopted in changes in log of prices, that is, $\log(p_t/p_{t-1})$x100. The descriptive statistics of the two price returns are shown in the Table.1.

It should be noted that the returns of oil is higher than the natural gas, however, the standard deviation is lower. The correlation between these two products is 0.289. The skewness of oil is negative while natural gas is positive. The oil series exhibit much higher excess kurtosis. The Jarque-Bera statistic also confirms that that the series are not normal distribution.

Table.1 The Summary Statistics

	Crude Oil	Natural Gas
Min	-21.045	-21.604
Max	18.598	22.852
Mean	0.044	-0.135
Median	0.327	-0.232
St.dev	4.028	6.469
Skewness	-0.612	0.126
Kurtosis	3.067	0.547
JB statistics	240.04(***)	8.229(***)
No. of observations	521	521
Correlation	0.289	

B. Modelling the dependence between the futures commodities

The results of both margin and dependence are shown in Table. 2. Since we use the one-step method, we present the two margins in all of the four copula models. We can see that the estimated parameters of GEV margins are consistent with each other. The shape parameter of crude oil is positive, while the natural gas is negative. That implies that the Oil future exhibits the heavy-tailed, while the Natural gas is thin-tailed. This result justifies the use of the GEV distribution, which can measure different shapes of tails. The Tawn copula has the best fit in in-sample analysis according to AIC. The Kendall tau of the Tawn copula is around 0.1.

Table 2 The Estimation Results of Four Extreme Value Copulas

	Gumbel Copula		Galambos Copula		Husler-Reiss Copula	
	Oil	gas	Oil	gas	Oil	Gas
mu	4.697	9.719	4.699	9.717	4.699	9.717
	(0.518)***	(1.097)***	(0.517)***	(1.098)***	(0.517)***	(1.097)***
beta	2.221	4.21	2.22139	4.208	2.221	4.208
	(0.376)***	(0.846)***	(0.376)***	(0.846)***	(0.376)***	(0.846)***
xi	0.093	-0.004	0.092	-0.005	0.092	-0.005
	(0.122)	(0.246)	(0.122)***	(0.246)***	(0.122	(0.246)***
r	(1.013)**		(0.061)*		(0.212)***	
AIC	253.549		253.557		253.557	

C. The Goodness of Fit Test

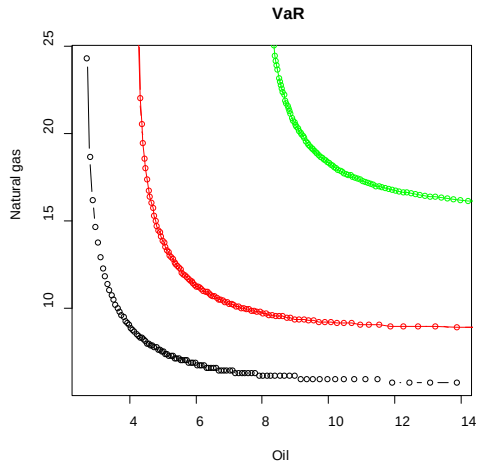
Table 3 Cramér–von Mises Statistics

	Gumbel	Galambos	Husler-Reiss
statistics	0.0343	0.0254	0.0212
p-value	0.467	0.513	0.528

Note: The p-value was obtained by using a boots tapping process.

In table 3, the CVM statistic and its corresponding P-value are presented. All of the three copula models are not reject the null hypothesis, therefore the three copulas are all proper for our study.

D. The in-sample VaR analysis



Note: the black mix line is VaR0.90, the red mixed line is VaR0.95, and the green mixed line is VaR0.99.

To estimate the multivariate VaR, we used the results of Gumbel Copula in in-sample analysis since it has the smallest AIC. The following steps are conducted, to obtain $VaR_{0.90}$ for the bivariate distribution. First, we give the first margin oil price as the 90% quantile of F_1, with the GEV distribution $0.9^{(24)}$ quantile (the observations in one block is 24), the VaR for the first margin is 2.72.

Second, to keep the quantile of bivariate distribution as 90%, by using the numerical method, we obtain the second margin 5.804, which is almost 99.9% quantile of F_2.

Third, repeat the first step and second step 100 times with accumulated 0.01 quantile of F_1 each time. That is, start from 90%, 91%, 92% quantile, until 99% quantile, we make 100 points and then draw the curves, as Fig.1.

Fig.1 shows that the lowest curve is $VaR_{0.90}$ for bivariate risk, and the higher curve is bivariate $VaR_{0.95}$. The top curve is the bivariate $VaR_{0.99}$.

In our study, the bivariate portfolio VaR is the sum of two margins such that the probability of bivariate distribution is equal to q. For the bivariate $VaR_{0.90}$, it is between [12.48, 27.01]. For the bivariate $VaR_{0.95}$, it is between [17.19, 31.15], and the last for $VaR_{0.99}$ of the bivariate distribution is between [28.21, 34.90]. Therefore, we receive a range of VaR, which has the worst and best situation. In our case, the VaRs is not much different than the independent copula, since the dependency parameter is quite small, the dependence is weak.

E. The Out-of-Sample VaR Forecasts

The out of sample are from the last three years of our data set, which is from January 2, 2012 to January 2, 2015, totally 144 observations. We use the 377 rolling window span to do forecasting, that is, drop first observation and add another latest observation. Therefore, we totally get 144 forecasting points. We use the violation rate to measure the performance of four extreme value copula. The benchmark method to estimate the VaR is the historical method, which is the nonparametric method. As same as the in-sample analysis, we fix the first margin to some level, such as for $\alpha = 0.90$, we fix the first margin as 0.95 quantile, and get the second margin, then sum them up. The results are shown in the Table 4. The backtesting method shows that comparing to the historical method, the Gumbel copula has better forecasting ability at 0.9 level. however, for the VaR0.95, it is not clear which method is better, this is because our data set is small. And also for our extreme value copula, the GEV margins are from each 24 observations; therefore the VaR is not that flexible and frequently change.

Table 4 The Violation Rate of Multivariate VaR

	Expected Violation	Gumbel Copula	Historical Method
VaR0.9	0.1	0.03	0.001
VaR0.95	0.05	0.00	0.00

IV. Conclusions

In this study, we present multivariate VaR of portfolio which consists of crude oil and natural gas futures by using the extreme value copula. It is a good tool to estimate the VaR due to the fact that extreme value copulas also specifically focus on the tail distribution and tail dependence.

Our out-of-sample results may be not strong evidence to prove that the extreme value copulas are superior to the other method, since the data set is small. The future work should use longer data span to verify it. The multivariate VaR measures also can be improved according to the literatures, such as the method in Embrechts, Höing, and Juri (2003) [17].

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Loss Distributions in Insurance Risk Management

V. Packová, D. Brebera

Abstract—Probability modelling has a wide range of applications in the field of insurance. An improvement of methods for reducing of actuarial risk in insurance company is effective tool for insurance risk management. While the risk assessment of insurance company in connection with her solvency is a complex and comprehensive problem, its solution starts with statistical modelling of number and amounts of individual claims. The objective of this article is to present possibilities how to obtain appropriate probability model that adequately describe the insurance losses and how to use such the model for the purposes of risk management. Modern computer techniques and statistical software open up a wide field of practical applications for this aim. The article includes application of presented methods based on data of claim amounts in motor third-party liability insurance.

***Keywords*—**Goodness of fit tests, loss distributions, Pareto distribution, reinsurance premium calculation.

I. Introduction

Although the empirical distribution functions can be useful tools in understanding claims data, there is always a desire to "fit" a probability distribution with reasonably tractable mathematical properties to the claims data. Therefore this paper involves the steps taken in actuarial modelling to find a suitable probability distribution for the claims data and testing for the goodness of fit of the supposed distribution [1].

A good introduction to the subject of fitting distributions to losses is given by Hogg and Klugman [2]. Emphasis is on the distribution of single losses related to claims made against various types of insurance policies. These models are informative to the company and they enable it make decisions on amongst other things: premium loading, expected profits, reserves necessary to ensure (with high probability) profitability and the impact of reinsurance and deductibles [1]. View of the importance of probability modelling of claim amounts for insurance practice several actuarial book publications dealing with these issues, e.g. [3, 4, 5, 6].

The conditions under which claims are performed (and data are collected) allow us to consider the claim amounts in non-life insurance branches to be samples from specific, very often heavy-tailed probability distributions. As a probability models for clam sizes we will understand probability models of the financial losses which can be suffered by individuals and disbursed under the contract by non-life insurance companies as a result of insurable events. Distributions used to model these costs are often called "loss distributions" [6]. Such distributions are positively skewed and very often they have relatively high probabilities in the right-hand tails. So they are described as long tailed or heavy tailed distributions.

The distributions used in this article include gamma, Weibull, lognormal and Pareto which are particularly appropriate for modelling of insurance losses. The Pareto distribution is often used as a model for claim amounts needed to obtain well-fitted tails. This distribution plays a central role in this matter and an important role in quotation in non-proportional reinsurance.

II. Claim Amounts Modelling Process

We will concerned with modelling claim amounts by fitting probability distributions from selected families to set on observed claim sizes. This modeling process will be aided by the STATGRAPHICS Centurion XV statistical analytical package.

Steps of modelling process follow as below:

1. We will assume that the claims arise as realizations from a certain family of distributions after an exploratory analysis and graphical techniques.
2. We will estimate the parameters of the selected parametric distribution using maximum likelihood based the claim amount records.
3. We will test whether the selected distribution provides an adequate fit to the data using Kolmogorov-Smirnov, Anderson-Darling or χ^2 test.

A. Selecting Loss Distribution

Most data in general insurance is skewed to the right and therefore most distributions that exhibit this characteristic can be used to model the claim amounts. For this article the choice of the loss distributions was with regard to prior knowledge and experience in curve fitting, availability of computer software and exploratory descriptive analysis of the data to obtain its salient features. This involved finding the mean, median, standard deviation, coefficient of variance, skewnes and kurtosis. This was done using Statgraphics Centurion XV package.

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The Distribution Fitting procedure of this software fits any of 45 probability distributions (7 for discrete and 38 for continuous random variables) to a column of numeric data represented random sample from the selected distribution. Distributions selected for our analysis aαe defined in Statgraphics Centurion as follow [7].

Gamma Distribution
Probability density function (PDF)

$$f(x)=\frac{\lambda^{\alpha}}{\Gamma(\alpha)}x^{\alpha-1}e^{-\lambda x},\ x>0 \tag{1}$$

with parameters: shape $\alpha>0$ and scale $\lambda>0$.

Lognormal Distribution
Probability density function (PDF)

$$f(x)=\frac{1}{\sigma\, x\sqrt{2\pi}}\,e^{-\frac{(\ln x-\mu)^2}{2\sigma^2}},\ x>0 \tag{2}$$

with parameters: location μ, scale $\sigma>0$.

Weibull Distribution
Probability density function (PDF) α β

$$f(x)=\frac{\alpha}{\beta^{\alpha}}x^{\alpha-1}e^{-(x/\beta)^{\alpha}},\ x>0 \tag{3}$$

with parameters: shape $\alpha>0$ and scale $\beta>0$.

A good tool when selecting a distribution for a set of data in Statgraphics Centurion is procedure *Density Trace*. This procedure provides a nonparametric estimate of the probability density function of the population from which the data were sampled. It is created by counting the number of observations that fall within a window of fixed width moved across the range of the data.

The estimated density function is given by

$$f(x)=\frac{1}{hn}\sum_{i=1}^{n}W\left(\frac{x-x_i}{h}\right) \tag{4}$$

where h is the width of the window in units of X and $W(u)$ is a weighting function. Two forms of weighting function are offered: *Boxcar function* and *Cosine function*.

The latter selection usually gives a smoother result, with the desirable value of h depending on the size of the data sample. Therefore in the application we will use Cosine function

$$W(u)=\begin{cases}1+\cos(2\pi u) & if\ |u|<0,5\\ 0 & otherwise\end{cases} \tag{5}$$

B. Parameters Estimation

We will use the method of Maximum Likelihood (ML) to estimate the parameters of the selected loss distribution. This method can be applied in a very wide variety of situations and the estimated obtained using ML generally have very good properties compared to estimates obtained by other methods (e. g. method of moments, method of quantile). Estimates are obtained using ML estimation in procedure Distribution Fitting in Statgraphics Centurion XV package.

The basis for ML estimation is Maximum Likelihood Theorem: Let $\mathbf{x}=(x_1, x_2, ..., x_n)$ be a vector of n independent observations taken from a population with PDF $f(x;\boldsymbol{\Theta})$, where $\boldsymbol{\Theta}'=(\Theta_1, \Theta_2, ..., \Theta_p)$ is a vector of p unknown parameters. Define the likelihood function $L(\boldsymbol{\Theta};\mathbf{x})$ by

$$L(\boldsymbol{\Theta};\mathbf{x})=\prod_{i=1}^{n}f(x_i;\boldsymbol{\Theta}) \tag{6}$$

The ML estimate $\hat{\boldsymbol{\Theta}}=\hat{\boldsymbol{\Theta}}(\mathbf{x})$ is that value of $\boldsymbol{\Theta}$ which maximises $L(\boldsymbol{\Theta};\mathbf{x})$.

C. *Goodness of Fit Tests*

Various tests may be used to assess the fit of a proposed model. For all tests, the hypotheses of interest are:

H_0: data are independent samples from the specified distribution,

H_1: data are not independent samples from the specified distribution.

From the seven different tests that offer the procedure Distribution Fitting of package Statgraphics Centurion XV we will use the next three:

Chi-Squared test divides the range of X into k intervals and compares the observed counts O_i (number of data values observed in interval i) to the number expected given the fitted distribution E_i (number of data values expected in interval i).

Test statistics is given by

$$\chi^2=\sum_{i=1}^{k}\frac{(O_i-E_i)^2}{E_i} \tag{7}$$

which is compared to a chi-squared distribution with $k-p-1$ degrees of freedom, where p is the number of parameters estimated when fitting the selected distribution.

Kolmogorov-Smirnov test (K-S test) compares the empirical cumulative distribution of the data to the fitted cumulative distribution. The test statistic is given by formula

$$d_n=\sup_x\left|F_n(x)-F(x)\right| \tag{8}$$

The empirical CDF $F_n(x)$ is expressed as follows:

$$F_n(x)=\begin{cases}0 & x\le x_{(1)}\\ \dfrac{j}{n} & x_{(j)}<x\le x_{(j+1)} \qquad j=1, 2, ..., n-1\\ 1 & x>x_{(n)}\end{cases} \tag{9}$$

where data are sorted from smallest to largest in sequence

$x_{(1)} \le x_{(2)} \le ..... \le x_{(n)}$.

Anderson-Darling test is one of the modifications of K-S test. The test statistic is a weighted measure of the area between the empirical and fitted CDF's. It is calculated according to:

$$A^2 = -n - \frac{\sum_{i=1}^{n}\left((2i-1)\cdot \ln\left(z_{(i)}\right) + (2n+1-2i)\cdot \ln\left(1-z_{(i)}\right)\right)}{n}$$

where $z_{(i)} = F_n\left(x_{(i)}\right)$.

In all above mentioned goodness of fit tests the small P-value leads to a rejection of the hypothesis H_0.

III. Pareto Model in Reinsurance

Modelling of the tail of the loss distributions in non-life insurance is one of the problem areas, where obtaining a good fit to the extreme tails is of major importance. Thus is of particular relevance in non-proportional reinsurance if we are required to choose or price a high-excess layer.

The Pareto model is often used to estimate risk premiums for excess of loss treaties with high deductibles, where loss experience is insufficient and could therefore be misleading. This model is likely to remain the most important mathematical model for calculating excess of loss premiums for some years to come [8].

The Pareto distribution function of the losses X_a that exceed known deductible a is

$$F_a(x) = 1 - \left(\frac{a}{x}\right)^b, \quad x \ge a \tag{10}$$

The density function can be written

$$f_a(x) = \frac{b \cdot a^b}{x^{b+1}}, \quad x \ge a \tag{11}$$

Through this paper we will assume that the lower limit a is known as very often will be the case in practice when the reinsurer receives information about all losses exceeding a certain limit.

The parameter b is the Pareto parameter and we need it estimate. Let us consider the single losses in a given portfolio during a given period, usually one year. As we want to calculate premiums for *XL* treaties, we may limit our attention to the losses above a certain amount, the "observation point" *OP*. Of course, the OP must be lower than the deductible of the layer for which we wish to calculate the premium [9, 10].

Let losses above this *OP*

$$X_{OP,1}, X_{OP,2}, ..., X_{OP,n}$$

be independent identically Pareto distributed random variables with distribution function

$$F_{OP}(x) = 1 - \left(\frac{OP}{x}\right)^b, \qquad x \ge OP \tag{12}$$

The maximum likelihood estimation of Pareto parameter b is given by formula

$$\frac{n}{\sum_{i=1}^{n} \ln\left(\frac{X_{OP,i}}{OP}\right)} \tag{13}$$

The Pareto distribution expressed by (10) is part of the *Distribution Fitting* procedure in Statgraphics Centurion XV package. This allows us to use the Pareto distribution to calculate the reinsurance risk premium. Risk premiums are usually calculated using the following equation:

risk premium = expected frequency × expected loss

The expected frequency is the average number of losses paid by reinsurer per year. For a given portfolio we should set *OP* low enough to have a sufficient number of losses to give a reasonable estimation of the frequency *LF*(*OP*).

If the frequency at the observation point *OP* is known than it is possible to estimate the unknown frequency of losses exceeding any given high deductible a as

$$LF(a) = LF(OP) \cdot P(X_{OP} \rangle\, a) = LF(OP) \cdot \left(\frac{OP}{a}\right)^b \tag{14}$$

The reinsurance risk premium RP can now be calculated as follows:

$$RP = LF\left(a\right) \cdot EXL \tag{15}$$

where

$$EXL = E\left(X_a\right) = \frac{a \cdot b}{b-1}, \qquad b > 1 \tag{16}$$

IV. Application of the Theoretical Results

Practical application of theoretical results mentioned in previous chapters we will performed based on data obtained from unnamed Czech insurance company. We will use the data set contains 1352 claim amounts (in thousands of Czech crowns - CZK) from the portfolio of 26 125 policyholders in compulsory motor third-party liability insurance.

We will start by descriptive analysis of sampling data of the variable *X*, which represents the claim amounts in the whole portfolio of policies.

Table 1 Summary statistics for X

Count	1352
Average	1376,29
Median	996,0
Standard deviation	1705,32
Coeff. of variation	123,907%
Minimum	1,0
Maximum	24986,7
Skewness	5,0977
Kurtosis	42,7794

Tab.1 shows summary statistics for *X*. These statistics and Box-and-Whisker plot confirm the skew nature of the claims

data. Also by density trace for *X* in Fig. 2 can be concluded that loss distribution in our case is skew and long or heavy tailed.

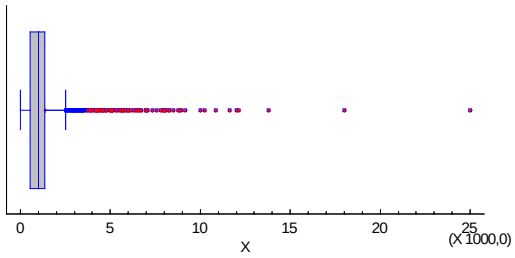

Fig. 1 Box-and-Whisker plot of claim amounts data

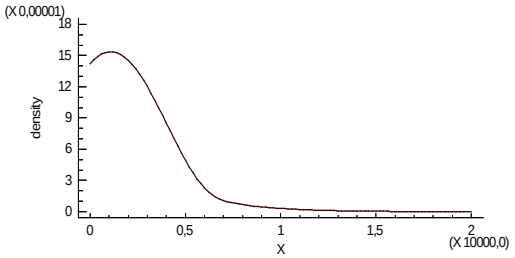

Fig. 2 Density Trace for *X*

The results of exploratory analysis justify us to assume that gamma, lognormal or Weibull distributions would give a suitable model for the underlying claims distribution. We will now start to compare how well different distributions fit to our claims data. The best way to view the fitted distributions is through the Frequency Histogram. Fig. 3 shows a histogram of the data as a set of vertical bars, together with the estimated probability density functions.

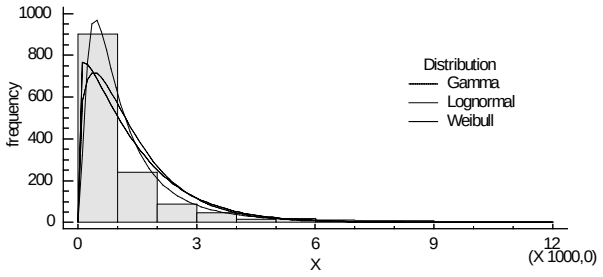

Fig. 3 Histogram and estimated loss distributions

From Fig. 3 it seems that lognormal distribution follows the data best, it is also suitable for both small and large claims. It is hard to compare the tail fit, but clearly the all distributions have high discrepancies at middle claims intervals.

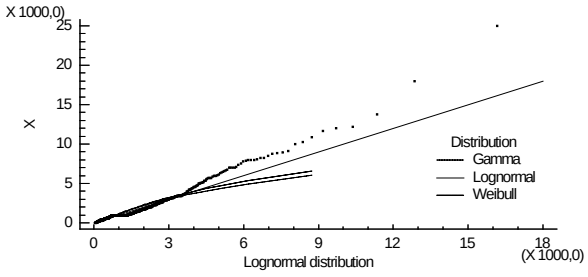

Fig. 4 Quantile-Quantile plot of selected distributions

The Quantile-Quantile (Q-Q) plot shows the fraction of observations at or below X plotted versus the equivalent percentiles of the fitted distributions. One selected distribution, in our case lognormal, is used to define the X-axis and is represented by the diagonal line. The others are represented by curves.

In Fig. 4 the fitted lognormal distribution has been used to define the X-axis. The fact that the points lay the most close to the diagonal line confirms the fact that the lognormal distribution provides the best model for the data in comparison with other two distributions. Unfortunately, all selected distributions deviates away from the data at higher values of *X*, greater than 4000 CZK of X. Evidently, the tails of these distributions are not fat enough.

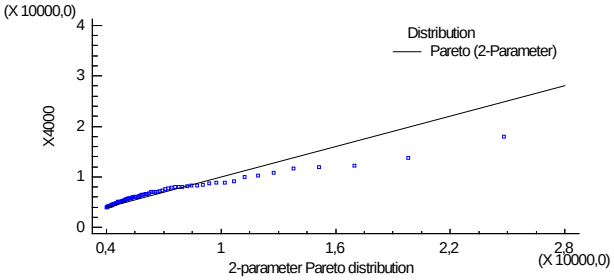

Fig. 5 Quantile-Quantile plot for Pareto distribution of X_{4000}

In the Fig. 5 the fitted Pareto distribution has been used to define the X-axis. The fact that the points lie close to the diagonal line confirms the fact that this distribution provides a good model for the clam amounts data above 4 million CZK.

Despite the adverse graphic results we will test whether the selected distributions fit the data adequately by using Goodness-of-Fit Tests of Statgraphics Centurion XV.

Table 2 Estimated parameters of the fitted distributions

Gamma	*Lognormal*	*Weibull*
shape = 1,41869	mean = 1355,69	shape = 1,0931
scale = 0,001031	Std. Dev. = 1438,37	scale = 1433,38
	Log mean = 6,83502	
	Log std. dev. = 0,868387	

The estimated parameters of the fitted distributions are shown in Table 2.

Table 3 Anderson-Darling Goodness-of-Fit Tests for *X*

	Gamma	*Lognormal*	*Weibull*
A^2	45,5961	21,8625	53,1055
Modified Form	45,5961	21,8625	53,1055
P-Value	<0.01	<0.01	<0.01

Table 3 shows the results of tests run to determine whether *X* can be adequately modelled by gamma, lognormal or Weibull distributions. P-values less than 0,01 would indicate that X does not come from the selected distributions with 99% confidence.

Table 4 shows the results of chi-squared test by (7) run to determine whether X can be adequately modelled by

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lognormal distribution with parameters estimated by ML. Since the smallest P-value is less than 0,01, we can reject the hypothesis that X comes from a lognormal distribution with 99% confidence.

Table 4 Chi-Squared test with lognormal distribution

	Lower Limit	*Upper Limit*	*Observed Frequency*	*Expected Frequency*	*Chi-Squared*
below		500,0	303	321,07	1,02
	500,0	3000,0	930	911,03	0,40
	3000,0	5500,0	72	92,41	4,51
	5500,0	8000,0	30	18,57	7,03
	8000,0	10500,0	10	5,38	3,98
above	10500,0		7	3,55	3,36

Chi-Squared = 20,2961 with 3 d.f. P-Value = 0,000147369

Table 4 confirmed the poor fit with the lognormal distribution especially for the claim amounts more than 3 million KCZ and Fig. 4 for the claim amounts more than 4 million KCZ. By Fig. 5 we can assume that a good model for losses above 4 million KCZ can be Pareto distribution with PDF expressed by the formula (11).

Table 5 Estimated parameters by ML

Pareto (2-Parameter)
shape = 2,07701
lower threshold = 4000,0

Table 6 K-S goodness-of-fit tests for X_{4000}

	Pareto (2-Parameter)
DPLUS	0,0589548
DMINUS	0,128705
DN	0,128705
P-Value	0,172365

There is 74 values ranging from 4000 to 24986,7 thousand KCZ. Table 5 and Table 6 show the results of fitting a 2-parameter Pareto distribution to the data on X_{4000}. The estimated parameters of the fitted distribution are shownin Table 5. The results of K-S test whether the 2-parameter Pareto distribution fits the data adequately contain Table 6. Since the P-value = 0,172365 is greater than 0,05, we cannot reject the hypothesis that sampling values of the variable X_{4000} comes from a 2-parameter Pareto distribution with 95% confidence.

Suppose the insurance company wants to reduce technical risk by non-proportional XL reinsurance with priority (deductible) a = 10 000 (thousand KCZ). Pareto distribution for variable X_{4000} with parameters from Table 5 we will use to determine reinsurance risk premium by (15). As OP we put value 4000. To calculate $LF(a)$ by (14) we need to know $P(X_{OP} \rangle a)$. We can use Tail Areas pane for the fitted 2-parameter Pareto distribution. It will calculate the tail areas for up to 5 critical values, which we may specify. The output indicates that the probability of obtaining a value above 10000 for the fitted 2-parameter Pareto distribution of X_{4000} is 0,149099, as we can see in Table 7. The value of $LF(OP)$ we can estimate by relative frequency of the losses above 4000:

$$LF(OP) = \frac{74}{1352} = 0,054734$$

Table 7 Tail Area for X_{4000} Pareto (2-Parameter) distribution

X	*Lower Tail Area (<)*	*Upper Tail Area (>)*
10000,0	0,850901	**0,149099**

Then by (14) we get

$$LF(a) = LF(OP) \cdot P(X_{OP} \rangle a) = 0,0547 \cdot 0,1491 = 0,007712$$

So that we can use the formulas (15) and (16) to calculate the reinsurance premium RP we will fit the 9 values ranging from 10000,0 to 24986,7 of the variable X10000 by Pareto (2-Parameter) distribution using Statgraphics Centurion Goodnes of fit procedure. The rsults contain the Table 8 and Table 9.

Table 8 Estimated parameters by ML

Pareto (2-Parameter)
shape = 3,65624
lower threshold = 10000,0

Table 9 K-S goodness-of-fit tests for X_{10000}

	Pareto (2-Parameter)
DPLUS	0,157301
DMINUS	0,105537
DN	0,157301
P-Value	0,979142

Table 9 shows the results of tests run to determine whether X_{10000} can be adequately modelled by a 2-parameter Pareto distribution with ML estimated parameters in Table 8. Since the P-value = 0,979142 is greater than 0,05, we cannot reject the hypothesis that values of X_{10000} comes from the 2-parameter Pareto distribution with 95% confidence.
You can also assess visually how well the 2-parameter Pareto distribution fits by selecting Q-Q graph on Fig. 6.

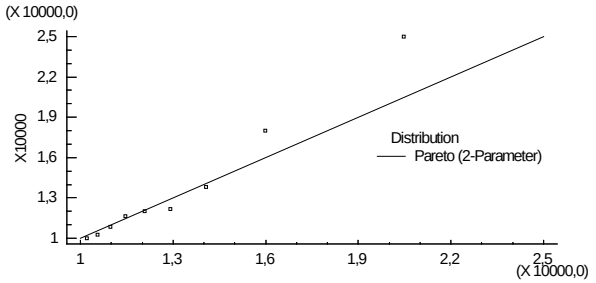

Fig. 6 Quantile-Quantile plot for Pareto distribution of X_{10000}

By values of estimated parameters in Table 8 we can calculate

$$E(X_a) = \frac{a \cdot b}{b-1} = \frac{1000 \cdot 3,65624}{2,65624} = 13764,72$$

Then by formula (15) we get reinsurance premium in thousand KCZ:

$$RP = LF(a) \cdot EXL = 0,007712 \cdot 13764,72 = 106,16.$$

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Conditions for entrepreneurship development in creative industries in Portugal[1]

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Abstract – Creative Industries are at the core of the development of modern societies, fuelling innovation and promoting the development of new business models. However, the adequate conditions for the development of Creative Industries are not usually created spontaneously, and must be developed. At the same time, likewise other types of entrepreneurs, creative entrepreneurs present some idiosyncratic characteristics that make them "special". In this paper we present the preliminary results for Portugal, of a large study conducted among creative entrepreneurs in some Southern European countries, namely Portugal, Spain and Greece, and in the UK, under an EU project. The main objective of this paper is to present the conditions that established creative entrepreneurs in Portugal consider vital for the start-up phase and the inherent development of their businesses.

We conclude that the development of creative entrepreneurship has implicit specific characteristics that differentiate it from the overall entrepreneurship picture, and that creative entrepreneurs, although present also some differences according to the different sectors of creative industries considered, are in themselves different from the general entrepreneurs. This may have consequences at the level of public policies conception and implementation that must be considered by the countries that want to promote entrepreneurship in Creative Industries.

Keywords — Creative industries; Entrepreneurship; Fear of failure; Entrepreneurship policies.

I. Introduction

Audretsch and Thurik (2004)[4] identified two different economic models where the political, social, and economic response to an economy were dictated by particular forces, i.e.: the managed economy and the entrepreneurial/knowledge-based economy. In the first one, the force is large-scale production, reflecting the predominant production factors of capital and unskilled labor as the sources of competitive advantage. In the second one, the dominant production factor is knowledge capital, which is complemented by entrepreneurship capital, representing the capacity to engage in and generate entrepreneurial activity. In each economic model, institutions are created and modified to facilitate the activity that serves as the driving force underlying economic growth and prosperity.

Throughout EU countries one can observe different tailor-made policies that comprehend these two modes in a symbiotic way. However, there is a general trend to promote the development of Creative Industries aiming to stimulate economic development. Economic policies with this aim often comprise dedicated policies for its sub-sectors and show an explicit attention for creative entrepreneurs, either deriving from national governments or regional/local authorities.

Creative Industries are at the core of the development of modern societies, fuelling innovation and promoting the development of new business models.

II. Conditions for Entrepreneurship in Creative Industries

Research in Creative Industries analyses a specific sector or various subsectors and respective interrelations. Examples of specific subsector analysis focuses on TV industry [1], cinema [2], games [3], VFX production [4], crafts [5] or digital media [6]; authors have studied subsector interrelations (e.g. based upon design subsector [7]), or artisan and commercial entrepreneur's 'types' (e.g. [8] ; [9] ; [10]).

Motivation aspects of creative entrepreneurs' establishment combine pull (e.g. dissatisfaction with previous job) and push (e.g. self-fulfillment) factors ([11]; [12]).

Usually, artistic orientation of creative entrepreneurs is more associated to lifestyle motivation (work/life balance, geographic location) than financial aims [13]. This orientation also shows an on-going dilemma of creative entrepreneurs in terms of personal satisfaction versus output to 'fit' the market ([14]; [15]) which challenges the normal mainstream of entrepreneurship principles.

Research on geographical context also focus mainly on 'hard' and 'soft' factors to explain why certain areas attract Creative Industries (e.g. [16] ; [17] ; [18] ; [19]). The analysis of creative cluster development is based upon several variables such as business support, cultural and financial infrastructures, markets (local, regional, national and international), scale and scope of Creative Industries, public and institutional promotion, in order to study creative strategies (dependent,

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aspirational, emergent and mature) [20]. Cultural infrastructures can play an essential incubator role when combined with university training programs [21].

According to Rae [22] contextual learning can be developed through immersion within the industry and opportunity recognition by cultural participation. Learning is often technical, functional and problem solving in order to develop skills, gain experience (often as employees) and 'train' social contacts to 'discover' a specific subsector. Opportunities are often recognized through the industries' social networks through the identification of specific needs, problems and potential customers (idem).

In some sense, the definition of Creative Industries can be associated with that of social networks: "*the set of agents and agencies in a market characterized by adoption of novel ideas within social networks for production and consumption*" [23]. This economic activities create and maintain social networks. Production and consumption generated 'values' are associated with social network choices and are uncertain and novel by nature [24].

Social networks are rooted in particular places where cultural production and consumption benefit from proximity. Opportunities arise based upon face-to-face contacts, information exchange or mentoring ([25]; [26]; [27]). The importance of the local networks can change according to the entrepreneur's development stage: in the start-up phase entrepreneurs seek for collaboration and feed-back from established entrepreneurs and also from neighborhood friends and acquaintances, taking advantage of meeting places as clubs and bars; when they are more established entrepreneurs look forward to reach networks with higher levels of scale (urban or even international) and consider the meeting places just for personal enjoyment [28].

Creative workers reveal convergence between sub-sectors and multiple roles across sub-sectors or along the value chains. For example, the design subsector in London has at least one company connected with all the main other sub-sectors of Creative Industries, and it is frequent that design subsector accept workers from other sub-sectors or design workers contracting [29]. Network opportunities lie either on formal organizations (fixed in time and space) or on less formal organizations (multiple times and spaces, open access principle – e.g. communities of practices) ([30]; [31]). Artisan local networks tend to be horizontal and strong (close relationship between entrepreneurs) while commercial local networks tend to be more vertical and weaker (labor force contracting or firms contracting other local firms) [32].

Social network analysis has been studying core/periphery structures of groups and organizations (e.g. [33]; [34]; [35]; [36]; [37]). In some sub-sectors like film industry, individuals who are integrated at the core have greater access and exposure to relevant sources of legitimacy and support, whereas they face difficulties to generate new ideas and to escape from the established norms of the field ([38]; [39]). The strong presence of public institutions in the formal 'upper ground' can create a lock-in effect for freelance workers who interact mainly within the 'underground' levels [40]. Gatekeepers can connect some actors and provide favorable conditions to maintain long-term relationships, although other actors can be marginalized and separated from de network-core preventing knowledge seeking initiatives ([41]; [42]), market opportunities in urban centers in sub-sectors like film industry [43] or potential clients for outer-suburban areas [44].

In small businesses of the TV industry the network of suppliers and production facilities of large companies explain the low investment in equipment. Larger companies function as a hub for formal and informal network. Formal networks are suitable to obtain information especially in terms of opportunities recognition. Informal networks are essential to get work and to make television programs based upon additional services required by small businesses ([45]; [46]).

III. CREATIVE INDUSTRIES IN PORTUGAL

For Portugal, and specifically for the purpose of this paper we will follow a definition of Creative Industries that joins the considerations of Portuguese National Statistics Institute (INE) [47] and Mateus [48]. The mix of these two definitions renders the most similar definition of Creative Industries that we have followed for the purpose of the survey conducted in Portugal.

According to INE [49], the creative and culture activities include the following sub-sectors: cultural heritage (museums); visual arts; periodical publications; cinema; performing arts; architecture; and broadcasting. Yet, figures considered by INE do not include sub-sectors like IT or engineering. For the purpose of our survey, besides INE's considerations, we also included, as in Mateus, the following sub-sectors of Creative Industries : film, video games, apps, web design, software, advertising/branding, design, craft, print, retail, food/catering and environmental.

In 2011 we observed that the cultural and creative industries represented around 1,6% of total employment in Portugal, employing a total of about 77.000 persons. In 2012, based on the Labour Force Survey [50], the creative and cultural sector employed 78,6 thousand individuals. From those, 62,1% were aged between 25 and 44 years old, 53,1% were men, and 37,8% had completed a tertiary level of education. Between 2000 and 2011 Creative Industries in Portugal have created more than 22.000 jobs, although they have lost about 4.000 jobs in the same period, in line with the overall economy in terms of general decrease in employment. In 2011, based on the Integrated Business Accounts System, the "advertising agencies" represented 19,3% of total business volume of the cultural and creative sector (5,1 billion Euros) and the "performing arts" activities reached 27,9% of all sector enterprises (53 064) [51].

Between 2002 and 2011 [52] the international exchanges of Portugal in goods and services of the Creative Industries represented between 3% and 4% on average, of total country exports, showing the following trends:

- The annual average growth rate of exports exceeded 10% in the last decade, above the rhythm of overall exports of the Portuguese economy (9,8%). The creative services grew around 15% while the creative goods exports grew just at a rate of 7%;
- Portuguese Creative Industries' exports recovered from 2009 international crisis in line with the main export sectors like electric equipment our food;
- Their contribution to total exports growth was around 3% since 2002;
- The annual growth of Creative Industries imports was around 7% in the same period (7,7% for the same indicator in the overall economy);
- The coverage exports rate in Creative Industries has raided in recent years: around 66% between 2003 and 2006 and 95% of imports in 2011.

Portugal is in the E.U. 16th position in terms of creative production, and in 27th position in the global ranking, between Ireland and United Arab Emirates. Comparing creative production and wealth, Portugal shows positive results in face of similar or more developed countries like, Italy, Spain, Greece or Slovenia. Yet Estonia has a similar wealth level and is in 10th position in the global ranking [53]. Creative production is one of seven criterion in which is based the world innovation index. This index evaluate the conditions and outcomes of global innovation in Creative Industries. Based upon a partnership between World Intellectual Property Organisation, INSEAD and Cornell University, this is the first international index which develops a preliminary creativity analysis in more than 140 countries.

According to the Government Budget, the consolidated expenditure of the State Secretary of Culture reached a total of 167,7 million Euros in 2012 (a decrease of 22,2% over 2011). According to data collected through the Survey on Public Financing of Cultural Activities, in 2012 the Municipalities allocated 401,5 million Euros to cultural activities, mainly in the following areas: cultural precincts (19,2%) cultural heritage (17,7%), books and press (14,6%), socio-cultural activities (13%) and music (6,4%) [54].

In the last four years municipalities have tried to enhance the creation and development of creative hubs, linked to local industries. More and more this becomes evident in several regions of Portugal (two of the most emblematic examples being the municipalities of Cascais and Lisbon). Within this increasing local movement, we can observe that several international fora are being organized on a local basis, held in several municipalities with the main objective of promoting future collaboration and meeting spaces of production and creative incubation at a regional, national and also at an European level, and thus, encourage the exchange of experiences on the needs in terms of infrastructure, business models, skills, management training and education of these organizations.

There is a clear intention to create the foundations for the development of an international network of spaces dedicated to the promotion of a creative economy and also to enhance the discussion of public policies to support the basis of an appropriate development of the creative sector within the new framework of EU programming.

Some good practices have been developed in the Creative Industries to overcome the referred situation, of which we highlight the "National Prize for the Creative Industries" or the "Lisbon Challenge", promoted by Beta-I, a recently created incubator that developed a very interesting acceleration program and entrepreneurship contest that included the Creative Industries.

In the North of Portugal, where we saw the main rise-up of Creative industries, it is also interesting to mention the creation of Oliva Creative Factory, a newly created incubator mainly dedicated to Creative Industries' start-ups, at the same time that we noticed the decrease of activity in one of the first incubators dedicated to this industry, i.e. the inSerralves incubator.

In 2009 in the Northern Region of Portugal we could count around 93 university graduations corresponding to about 3.700 vacancies in courses providing human resources to the development of different creative areas. Notwithstanding, in the absence of regional data, and according to regional support entities, this apparent favourable background for entrepreneurship in Creative Industries resulted in a few creative business initiatives for firm projects in the region. This is clearly a sign that the link between universities and the market is still weak: the majority of the almost 5.000 recently graduates in Creative Industries' courses did not create their own business. This is a phenomenon that we can observe in other Portuguese sectors. However, the situation in Creative Industries, especially in the 'cultural' sub-sector, has even worst results in terms of self-employment [55].

IV. EMPIRICAL RESEARCH ON CREATIVE INDUSTRIES IN PORTUGAL

The present paper is based on an empirical research developed in Portugal aiming to analyse the conditions for the development of entrepreneurship and the conditions for success of Creative Industries in Portugal.

This inquiry consisted on a set of five semi-structured interviews with responsible from several institutions dedicated to promote entrepreneurship in Portugal, and also on a survey directed to Creative Industries in Portugal.

Considering the interviews that we were able to conduct with national experts on entrepreneurship, and particular those responsible for different Programs and Entrepreneurship institutions in Portugal, there is a general opinion that there exists clearly an adequate infrastructure for the development of entrepreneurship in the Creative Industries in Portugal. In fact,

national experts consider that apparently there is even a lack of demand for services from the potential entrepreneurs within the Creative Industries sector, compared to the institutions and respective services available (especially in some regions of our country) to provide them.

Generally, opinions obtained from the persons interviewed pointed that creative businesses linked to cultural industries are usually developed by entrepreneurs that show a significant lack of management and organization skills. According to the interviewees, in earlier stages of development of their projects, the support creative entrepreneurs can get from incubators is crucial but insufficient. However, we consider that a fine tuning of this conclusion needs to be conducted, since we are not able to conclude effectively if the reason for this situation remains on the incapacity of existent incubators and other entrepreneurship institutions to effectively support the overall needs of entrepreneurs (which we hardly believe), or is explained by the incapacity of entrepreneurs, or would-be entrepreneurs, to identify adequately what are their needs, and ask it to the existent institutions (that we tend to believe that is the more effective reason).

Notwithstanding, according to the interviewees, regarding the entrepreneurs' general availability and aptitude to receive training, it seems that there is a natural difference between cultural and creative entrepreneurs, especially those more related with digital media and software development. The mind set of these last ones seems to be keener to mathematics and management than that of the entrepreneurs more linked with cultural industries.

Another crucial issue when we speak about creative industries is the setting up and development of networking.

In Portuguese Creative Industries we observe remarkable differences regarding information and communication technologies' networks (including businesses in digital media like software for communication technologies) and 'cultural' networks (here included architecture, arts, handicraft, fashion design, cinema and video, music, theatre): whereas information and communication technologies networks show very interesting dynamics and potential for development, 'cultural' networks are almost absent in the Portuguese scenario, and need higher quality business projects.

In networks of industrial software applied to communication technologies, entrepreneurs' collaboration strive for obtaining inputs and advise directed to identify and explore new opportunities for innovation, to have access to technological and scientific knowledge, and to support management and strategic firm decisions [56]. Firms constitute the most relevant origin of resource utilization and they have a leading role in knowledge networks. Informal networks permitted searching for immediate practical problems (market segments information, access to clients) and for long-term problems (strategy implementation, market segments identification) [57]. In this network, mobile communication companies (Vodafone and the former Optimus, now NOS, and TMN, now MEO) and a multinational (IBM) are brokers that provide new information for small firms regarding innovation and technological and scientific knowledge. The broker role is particularly important in the case of a large company whose size, reputation and credibility make it a preferential partner to foster innovation and knowledge diffusion by establishing links between universities and national firms. Strong links between spin-offs and parent organizations (mostly firms) are based on multiplex ties (ties which result in more than one type of knowledge flux) and informal connection between national and multinational firms of the same sector (e.g. firms for software development) ([58]; [59]).

In general we observed that Portuguese entrepreneurship culture was, until recently, essentially closed and not favourable to network dynamic. Contrary to 'cultural' businesses, however, mainly information and communication technologies businesses have been undertaking a change in entrepreneurs' behaviour for information and resource exchanges, common projects and exploration of informal networks for business creation and development. A recent inquiry [60] directed to 30 entrepreneurs of Portuguese COTEC SME Network - of which 63,3% represented the information and communication technologies sector – revealed this kind of dynamics. The main advantages mentioned by entrepreneurs members of this network were innovation stimulation (66,7% of total SME inquired), access to pertinent information (66,7%), greater social recognition and promotion of the company (63,3%), access to new knowledge and to training networks (43,3%), closer contact with other start-ups and spin-offs (50,3%) and better access to innovations within their own business sector (43,3%). In terms of resource sharing, a large number of SME (73,3%) considered that the network fostered a continuous innovation culture and 63,3% mentioned cooperation with other companies in the network. Of the companies that cooperated with others, 47% stated cooperation with others to foster innovation and 53% referred that cooperation resulted in creation of new business opportunities.

In comparison, we observe that 'Cultural' networks of entrepreneurs present weaker dynamics. Although entrepreneurs show very interesting levels of potential talents, cultural networks lack a human resource 'critical mass' for quality business projects and entrepreneurs are not well organized in terms of effective collaboration. Frequently there is a juxtaposition of creator/promoter role and consumer role. Informality this is often due to agent's condescension. That is inherent to a 'tradition' of subsidize dependency and lack of professionalism. The almost absence of network's dynamic is also related to difficulties in project survival, financial sustainability and market penetration [61].

Based on the analysis of the 5 semi-directed interviews conducted between September and October 2014, we developed a questionnaire aiming Creative Industries entrepreneurs in Portugal, which was conducted between November 2014 and January 2015. At the end of January 2015

we've obtained some preliminary results for 17 questionnaires completed answered.

Entrepreneurs were chosen randomly and the results do not pretend to be representative of the whole Creative Industries entrepreneurs' universe. However we tend to believe that these results represent the general opinion and view of most of the Creative Industries entrepreneurs in Portugal.

In a scale of 1 to 4 (being 4 the value for 'totally disagree' and 1 corresponding to 'totally agree') we started by analysing the importance of education for entrepreneurship development in the Creative Sector in Portugal. According to our preliminary results, education is considered very relevant to develop a sense of initiative and an entrepreneurial attitude (mean: 3,06). Also, Education seems important to understand better the role of entrepreneurs in society (2,65), and at the same time seems important to increase the interest in becoming an entrepreneur (2,53), giving useful skills and know-how to run a business (2,59).

The questionnaire also inquired about the crucial elements to start a creative business in Portugal. In a 1 to 4 scale (from 'not important at all' to 'very important'), according to the answers received the most important elements to start a business are: an appropriate business idea (3,59); the capacity to address an unmet need (3,53); the importance of a role model (3,06); the possibility of getting the necessary financial resources (3,00); and the possibilities of contact with an appropriate business partner (3,00). Dissatisfaction with previous work situation (2,76) is also worth mentioning.

In an opposite sense, the main difficulties to start a business in Creative Industries are the lack of available finance (3,06); the situation of not having a second change in the case of failure (2,94) and also the complex administrative procedures (2,65).

Questionnaire also inquired about fund provisioning for the newly creative businesses in the Creative Industries in Portugal. According to the entrepreneurs' opinions, the most important initial source of funding for the business was self-funding (for 47% of the entrepreneurs), followed at the same level (24%) by family or friends, business angels funding, and personal bank overdraft (24%). Grants (18%) and business loan from banks (12%) seemed to be the least sources of funding used to start a business in the Creative Industries.

Motivations for entrepreneurship development are often referred in the literature as one of the most important drivers of entrepreneurship in any country, just balanced by aversion to risk.

In the Creative Industries in Portugal, motivation for self-employment derive mostly from the "*desire for personal independence/self-fulfilment*", gathering 82% of the answers, and also from the "*desire to contribute to societal development*" (with 71% of the answers), whereas "*the willingness to exploit a business opportunity*" seems to be the motivation of just 53% of the inquired entrepreneurs, exactly at the same level of the "*freedom to choose place and time to work*".

In opposition to the above opinions, the most feared risks for opening a new business in the Creative Industries in Portugal seems to derive from the possibility of getting "*irregular income or not having guaranteed income*" (collecting 71% of the opinions) followed by "*the possibility of going bankrupt*" (47% of the answers).

As referred at the very beginning of our analysis, institutional support reveals crucial for entrepreneurship in general, but is even more important for Creative Industries' entrepreneurs. Thus, our questionnaire also investigated the importance of this support using a 1 to 10 ranking (from '*not at all useful*' to '*very useful'*). After an exhaustive analysis of the industry and based on the interviews' content analysis, we isolated the following main institutions dedicated to promote and support entrepreneurship in Portugal: National Support Institute for SME (IAPMEI), Local Municipalities, Local and National Incubators, Banks, Business Angels (BAs), Venture Capital (VC), Higher Education Institutions (HEI), Entrepreneurs' Associations, and Development Associations dedicated to Creative Industries..

For all institutions considered, external support for creative entrepreneurs scored between 3 and 4 (mean) although we have to register high standard deviations (5,06 to 7,76). This means that for each institution there are considerably different 'evaluations'. However, the support programmes for entrepreneurship have a higher score (6,63) presenting also a lower standard deviation (2,23).

The first year in business is known as the crucial year for business development. Creative Industries' entrepreneurs "*feeling of belonging to a community of other Creative Industries entrepreneurs*" in their local areas (using a scale from 1 to 10: from '*not at all*' to '*very much'*), reached a level of 6,63. In relation to this, 41% of the entrepreneurs considered that "*collaboration with local entrepreneurs for winning business is important in terms of raising money*". Also, joint participation in public tenders reveals very important for 35% of the entrepreneurs involved in the questionnaire. However '*sharing practical knowledge, skill and experience with other entrepreneurs'* scored just 3,05 (with a standard deviation of 4,12) and amazingly, collaboration '*is not important' at all´* for 29% of the entrepreneurs.

V. Conclusion

As referred at the beginning of our paper, this is part of an overall work in progress in different European countries, mostly from Southern Europe. Moreover, it was not our intention that the present study was based on a representative sample, even because there is not an exhaustive inventory of the existing Creative Industries btoh in terms of the number of existing companies or the regions where they are most located. However, from the preliminary results obtained from our study we may already confirm that the development of creative entrepreneurship has implicit specific characteristics that

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differentiate it from the overall entrepreneurship picture, also in Portugal.

Although not a homogeneous group (since they denote some marked differences according to the different sectors of creative industries considered, mainly derived from different personal characteristics), creative entrepreneurs are in themselves and as a group different from the general entrepreneurs. Moreover, it seems that that are cultural differences that may represent significant differences in the way Creative Industries' entrepreneurs react to public policies stimulus. These results should be considered by public policies' key persons, because they may have consequences at the level of public policies conception and implementation which must be considered by the countries that want to promote entrepreneurship in Creative Industries.

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Using RSS in Advertising: Regional Trends and Global Issues

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Abstract: - This paper presents an analysis of regional experience in advertising via RSS (Really Simple Syndication) channels and the Internet. The regional experiences of Croatia, Bosnia, Herzegovina, Slovenia, Macedonia, Serbia, and Montenegro are presented. This paper addresses how society is ready to accept new forms of communication with advertisers in these regions. The authors analyzed the number of Internet users in order to select appropriate strategies and optimal models for advertisers via RSS aggregators and to determine a possible course of activities associated with this type of advertising on the Internet. In applied research, the tools for measurement, analysis and information gathering were gemiusTraffic and Google Analytics and they are analyzed in the form and extent of the uses of RSS to local and global markets. The applicability of that in the paper, especially in the category of creating viable options for further development of RSS, given the technology, cultural phenomena of use and marketing capabilities, will be the main strategic guidelines for the development of RSS in these regions.

Key-Words: Internet, Web 2.0, advertising, marketing, new media, RSS, regions, trends.

I. INTRODUCTION

In the nineteen nineties, marketing and advertising on the Internet were created by the emergence of the mass use of Internet broadband connections. Broadband connection access enabled marketing and advertising on the Internet through the development of interactive and multimedia applications and services. These applications and services created new markets, which, in turn, promoted and introduced the development of more service offerings.

High speed Internet access via broadband communications opens the way for the fulfillment of the vision of an information society. Insufficient availability of broadband Internet access, on the other hand, leads to the digital divide. This means a gap in the availability and utilization of development potentials for information and communication technologies between individuals, businesses and geographic areas.

"Power" or the potential of the Internet to achieve the vision of the information society is reflected in the technological development called Web 2.0. Web 2.0 represents a generation of technology solutions where interactive content is incorporated in the website. The subject of this paper is a specific tool that has emerged in a vast array of Web 2.0 technologies - RSS (Really Simple Syndication). Like any IT area, RSS technology is often developed haphazardly with most research focused on RSS practice. The possibility of using RSS technology in advertising rests on fundamental questions about the society in which we live, such as the society's philosophy and research methodology as it relates to mutual issues in the areas of technology, education and marketing. [1]

II. RSS AS A SOURCE OF INFORMATION

RSS and RDF Site Summary (Rich Site Summary) are collections of Internet formats used for writing and updating portals, blogs, forums and websites with frequently changing content (from changes of more than once a day to a few changes per second). Reading an article written using RSS can be more precisely understood than opening dozens of windows in an Internet browser to obtain the same information.

RSS information is a short message with a link that leads to the original (source) page of the site's owner. When a user reads information via RSS, the user can read all the information that has to come to the source page or just the updates of information published using RSS. This feature increases traffic and the number of Internet users who visit these sites looking for desired information. The research in this paper studies characteristic of RSS information applicable to advertising.

III. RSS AND ITS APPLICATION THROUGH THE INTERNET FOR THE PURPOSE OF ADVERTISING

Developing marketing is largely motivated by the need to analyze the relationships between the behavior of sellers and buyers. Prior to the 1950s, the marketing objective was primarily to sell more products and services, regardless of what the customers really wanted. Now a key factor in any successful marketing is to understand the needs and wants of customers. Therefore, the increase in the number of Internet users in the world is a strong argument for the use of Internet tools to understand these needs and wants. [2]

Date	Users (Millions)	World Population (%)
1995	16	0.4
1996	36	0.9
1997	70	1.7
1998	147	3.6
1999	248	4.1
2000	361	5.8
2001	513	8.6
2002	587	9.4
2003	719	11.1
2004	817	12.7
2005	1018	15.7
2006	1,093	16.7
2007	1,319	20.0
2008	1,574	23.5
2009	1,802	26.6
2010	1,971	28.8

Table 1 - Number of Internet Users in the World

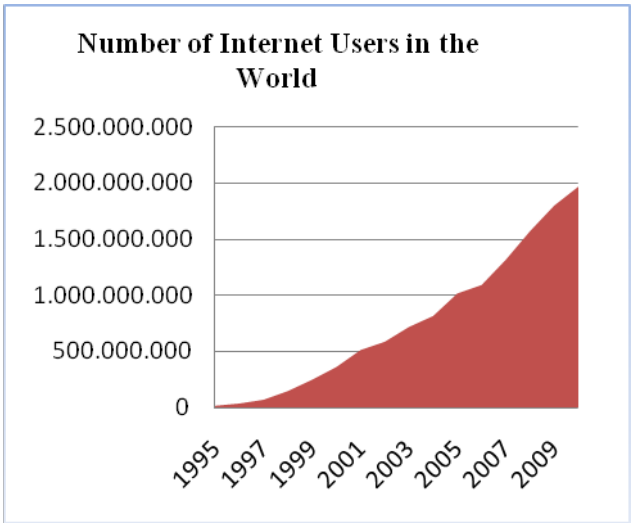

Fig. 1 - Number of Internet Users in the World

The Internet is an independent media; it cannot be fully controlled, so it is the most open of all the mass media.

In modern market conditions characterized by an extremely strong level of competition and by the maturity of most markets, the competitiveness and adaptability of the market, more than ever, are becoming important issues of performance, as well as survival. In the last four decades, in an effort to find the "recipe for success" there has been a significant paradigm shift in business - strategic focus once was oriented to predominantly the individual and to attract new customers. Now the paradigm has shifted and is oriented to develop and focus on profitable long-term customer retention. [3]

Despite rapid growth rates, use of the Internet in Croatia is still not at the level of the European Union and the United States. This fact implies a lack of information to the average customer. However, even with the perception of security issues, it opens the possibility of using the Internet as a distribution channel in modern society. There are positive examples of individual state systems that effectively use the Internet in business. To establish this overall system operation in Croatia, it is particularly important to find and define adequate and appropriate goals, strategies and implementation plans. Thus reflecting the Croatian situation, this can establish a sound and sustainable system to support the Internet in business.

Using software called an “RSS reader”, users can read articles whereby they select a topic of interest and monitor all new developments. For example, businesses, schools, and ministries can offer an RSS feed for their site daily with the latest information. Users will receive the information through the RSS feed and be informed of the latest developments. RSS feeds are becoming an increasingly popular way to read and search for new information. Big companies like Google, Yahoo, and Microsoft integrate RSS into their browsers. Today, RSS forms part of the new versions of Windows and Office applications. RSS feeds are becoming richer in content, using video in RSS feeds. More and more services, such as those delivering weather forecasts, lottery results, and sports scores, use RSS feeds. RSS feeds are downloaded to the user’s RSS reader where they stay until the user decides to view them. This means the user need not miss important information.

Some developers and vendors are trying to use the key parts of RSS technology and philosophy to develop better programs. Blogosphere and Internet news pages are not the only ones who want to expand the functionality of RSS to make information more accessible. BioCaster is a system that asks for and provides information about health risks, epidemics and other data relevant to health. One of the key technologies used by BioCaster is RSS newsfeeds. The program’s components read more than 1,700 RSS feeds (channels) specifically related to health care. The RSS feeds are automatically allocated to topic based on the relevant content. The idea is that the user, with an RSS reader, gets the information as close to real time as possible.

Since programs such as browsers and operating systems increasingly support RSS technology, it has the potential to become the primary tool through which users interact with the Internet. Also, RSS can offer an alternative to e-mail notification, alleviating concerns related to privacy and spam.

IV. RESEARCH INTERNET MARKET IN CROATIA

Although RSS technology is relatively new and the application and use of RSS newsfeeds and readers are only in their infancy, the new technology can be applied in Croatia. The reason for this is the growing number of Internet users in Croatia, as well as the increase in the number of smart phones through which users can connect to the Internet.

Choices and preferences of user's accessing the web on Croatian territory, as well as models for the transfer of these experiences, can be adapted to the specific conditions and needs of advertisers. This can be of direct

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benefit to advertisers by expanding possibilities for their development and long-term success. Market competition on the Internet requires programmers of websites to continue education on RSS technology and learn how this can be adapted to the specific conditions and needs of advertisers.

In 2007, gemiusAudience study, whose goal is to gather and update data with a view to optimizing online advertising campaigns, created a partnership with Valicon, a marketing research and consulting company. According to the results of gemiusAudience research, 49% of Croatians use the Internet on a monthly basis or more. Users report frequent use of the Internet for research and educational purposes.

According to data from January 2010, there were 1,503,688 Croatian Internet users older than 12 years of age. Of 268 Internet sties shown in this survey, the largest number of vistors were to sites such as www.net.hr, www.index.hr, www.tportal.hr, www.forum.hr, and www.24sata.hr. The top level domain name , '.hr'. represents the Croatian Academic and Research Network located in Zagreb, Croatia. (Note: most American servers use three-letter top level domains (e.g. '.com', '.edu'), while countries other than the USA commonly use two letters, or combinations of two letters (e.g. '.au', '.hr', '.co.jp')). All of the Internet sites mentioned previously are sites for the latest Croatian and world news, politics, sports, entertainment, psychology, lifestyle, etc.

Within this target group, the greatest portion was made up of students at 33% of the total. Those employed in the private sector made up 22% while public sector employees made up 18%. Also, according to this data analysis, 53% were women, who, on average, spent almost nine hours per month on the Internet. Men make up 47% , but are a more active target group, spending an average of 12 hours per month on the Internet.

Among these Croatian users, 77% use the Internet monthly or more frequently to search for information, while 66% use the Internet once a week or more to search for information. To search Croatian Internet space, 48% of Croatian customers use Microsoft Internet Explorer, 42% use Mozilla Firefox, followed by Google Chrome with 6%, and Opera at 3%. Less than 1% of users use search engines Safari, NetFront and Netscape. [4]

V. ANALYSIS OF RSS CONTENT GENERATED BY REGION

Fig. 2 and table 2 show the number of unique visits to RSS portals by region. Regions that are involved in the research are the regions of the former Yugoslavia (Croatia, Bosnia and Herzegovina, Slovenia, Macedonia, Serbia and Montenegro). According to the analysis of data for the period January 1, 2010, through December 31, 2010, it can be seen that the best results were achieved with Croatia, which had the highest number of visitors. Bosnia and Herzegovina were ranked second in the number of visits while Montenegro had the lowest number of visits. According to the number of users of this type of technology, the most profitable investments available in the market would be in Croatia.

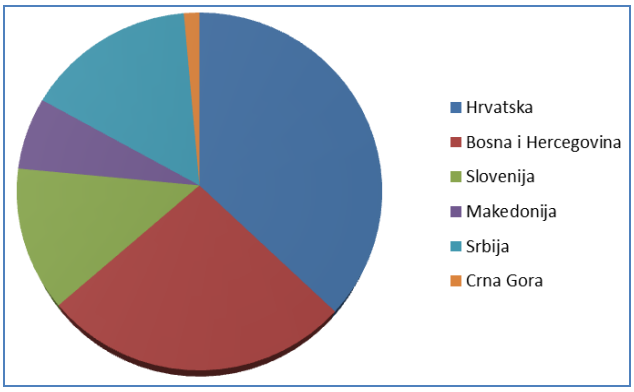

Fig 2 - Number of Unique Visitors, RSS Portals by Region

Number of Unique Visitors, RSS Portals	
Croatia	1,368,398
Bosnia and Herzegovina	977,576
Slovenia	476,081
Macedonia	241,402
Serbia	572,681
Montenegro	52,298

Table 2 - Number of Unique Visitors, RSS Portals by Region

VI. ANALYSIS OF INTERNET BROWSER BY REGION

Table 3 shows the five most used Internet browsers. Internet browsers Firefox and Internet Explorer are most accepted by users according to Google Analytics statistics. This information is essential for the development of access to Internet applications and testing products on the Internet. Each Internet browser has a different way of showing the content of the page. It may happen that the Firefox content would be displayed correctly, while in Opera or Chrome, the content is not in the visible part of the page, or is not presented in the way the concept of the page was designed. For this reason, the developers of Internet applications test display pages in all Internet browsers that are most likely to be used by the user.

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	Croatia	Bosnia and Herzego-vina	Slovenia	Mace-donia	Serbia	Monte-negro
1.	Firefox	Firefox	Firefox	Firefox	Firefox	Firefox
2.	Internet Explorer	Internet Explorer	Inter-net Explorer	Inter-net Explorer	Internet Explorer	Internet Explorer
3.	Chrome	Chrome	Chrome	Chrome	Chrome	Chrome
4.	Opera	Opera	Safari	Opera	Opera	Opera
5.	Safari	Safari	Opera	Safari	Safari	Safari

Table 3 - Analysis of Internet Browser by Region

VII. ANALYSIS OF RSS INTERNET PAGE LOCATION PORTALS USED, BY REGION

Table 6 shows the analysis of RSS Internet page location portals used by the regions covered by the survey. Through this analysis, it is evident which state Internet page location regional users prefer to generate information. According to these parameters, one can see that the most used RSS Internet page location portals are Croatian and thus the best market for marketing and advertising.

VIII. CONCLUSION

Although RSS technology is relatively new and the application and use of RSS newsfeeds and readers are only in their infancy, the new technology can be applied in Croatia, Bosnia and Herzegovina, Slovenia, Macedonia, Serbia and Montenegro. It is understood that there are no ready-made strategies; everyone needs to participate. Looking from the position of the owner or editor of Internet sites or portals via RSS, it can be concluded that every author of the article, news or other information that goes through the RSS feeder primarily has to answer the questions:

- What kind of information do the users want to receive? - Information viewpoint,
- How will this information be displayed and accepted? - Technological viewpoint,
- What is the target group of users to whom the information is intended? - Cultural viewpoint and
- What is the best business model to use, what kind of benefit does the website or portal expect, and what, if any, financial gain is expected? - Business viewpoint.

Based on these questions, as well as an analysis of research visits to the media by region, development strategies can be set up for RSS in four dimensions - information, technological, cultural and business. Each of these has a different point of view with regard to the types of information that the Internet site or portal contains. As the types of information related to the RSS can be divided into technical details or general information, each of the four dimensions has a different response to the defined type of RSS information.

Table 4 shows the development strategy for RSS in four dimensions, and describes each dimension with respect to the type of information (Professional data - Model 1 and the General Data - Model 2), as well as their possible applications.

Strategy for RSS in Four Dimensions			
Viewpoint Covering		**Model 1 – Professional Data**	**Model 2 – General Data**
Information	What' kind of information does the user want to receive?	Professional data that the author has published.	General information that the author of the published article possesses.
Technology	How will this information be displayed and accepted?	RSS reader on the Internet or program on user's PC.	RSS reader on the website or portal, RSS reader on the Internet, or program on user's PC.
Culture	What is the target group of users to whom the information is intended?	A small number of customers, specializing in a particular topic, or a small group of people.	A large number of users, publicly available to all users who follow the latest developments in the country and/or the world.
Business	What is the best business model to use, what kind of benefit does the website or portal expect, and what, if any, financial gain is expected?	Subscribe to a certain category of content, advertising space through images, pop-ups or sponsored articles.	Ad space through images, pop-ups or sponsored articles.

Table 4 - Strategy for RSS in Four Dimensions

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	Internet Access (%)			Broadband Connection (%)		
	2006	**2009**	**2012**	**2006**	**2009**	**2012**
EU27	49	66	76	30	57	72
Belgium	54	67	78	48	63	75
Bulgaria	17	30	51	10	26	51
Czech Republic	29	54	71	17	49	68
Denmark	79	83	92	63	76	85
Germany	67	79	85	34	65	82
Estonia	46	63	75	37	62	74
Ireland	50	67	81	13	54	65
Greece	23	38	54	4	33	51
Spain	39	54	68	29	51	67
France	41	69	80	30	63	77
Italy	40	53	63	16	39	55
Cyprus	37	53	62	12	47	62
Latvia	42	58	69	23	50	67
Lithuania	35	60	62	19	50	61
Luxembourg	70	87	93	44	71	68
Hungary	32	55	69	22	51	68
Malta	53	64	77	41	63	77
Netherlands	80	90	94	66	77	83
Austria	52	70	79	33	58	77
Poland	36	59	70	22	51	67
Portugal	35	48	61	24	46	60
Romania	14	38	54	5	24	50
Slovenia	54	64	74	34	56	73
Slovakia	27	62	75	11	42	72
Finland	65	78	87	53	74	85
Sweden	77	86	92	51	79	87
United Kingdom*	63	77	83	44	69	80
Iceland	83	90	95	72	87	91
Norway	69	86	93	57	78	86
Croatia**	41	50	66	23	39	60

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Montenegro	:	:	55	:	:	52
Former Yug. Rep. of Macedonia	14	42	:	1	34	:
Turkey**	20	30	47	17	26	43

Table 5 - Percentage of Households with Internet Access and Broadband Connection

Data not available.
* United Kingdom: 2011 instead of 2012, the EU27 for 2012 is calculated using United Kingdom data for 2011.
** Croatia and Turkey: 2007 instead of 2006. [5]

	Croatia	**Bosnia and Herzegovina**	**Slovenia**	**Macedonia**	**Serbia**	**Montenegro**
1.	Croatia	Bosnia and Herzegovina	Slovenia	Macedonia	Serbia	Serbia
2.	Bosnia and Herzegovina	Croatia	Croatia	Serbia	Bosnia and Herzegovina	Montenegro
3.	Serbia	Serbia	Serbia	Bulgaria	Montenegro	Croatia
4.	Slovenia	Germany	Germany	United States	Croatia	Bosnia and Herzegovina
5.	Germany	United States	Bosnia and Herzegovina	Germany	Macedonia	United States
6.	United States	Slovenia	United States	Italy	Slovenia	Slovenia
7.	Montenegro	Montenegro	Italy	Croatia	Germany	Macedonia
8.	Macedonia	Austria	Austria	Undefined	United States	Germany
9.	Austria	Macedonia	Macedonia	Switzerland	Austria	Undefined
10.	Undefined	Switzerland	France	Greece	France	Austria

Table 6 - Analysis of RSS Internet Page Location Portals Used, by Region

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Investments in Technology and Organizational Performance in KSA

M. Kolay, S. Ahmed, M. Munir, and V. Prasad

Abstract - Investments in technology by all listed organizations in thirteen sectors in the Saudi Stock Exchange, and its possible impact on organizational performance have been studied based on last four years annual average figures. The organizational performance has been assessed by five parameters, i.e., level of business, technology turnover, gross profitability, inventory holding reciprocal, and other current assets holding reciprocal. Three sectors, the energy and utilities, the petrochemical industries, and the telecommunication and information technology hold 80% of total technology deployment and account for 75% of total business. Ten companies that include nine from these top three technology intensive sectors hold 78% of total technology deployment and account for 72% of total business. However, organizational performance parameters do not show any significant relationship with the level of technology deployment. This may signal that technology investments have been made mostly to meet the basic needs of the specific sectors, and its extent of contribution towards organizational performance improvement needs to be assessed in conjunction with effectiveness of organizational human resource.

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***Keywords*—**Investments, Performance, Saudi Arabia, Technology.

I. Introduction

EVOLUTION of technology is indeed important in making our lives easier, for example, hospital stays shorter, cars more reliable, commercial air travel cheaper and vastly safer, workplaces more congenial, and food more diverse and healthful. Be it revolution or evolution, sustainability and high performance through technological progress have become the main mission of corporate organizations of each and every country in today's competitive global environment. Technological progress may occur via innovation or imitation, but the concept of learning-to-learn must be incorporated into both imitative and innovative processes for sustained success, particularly when technology has been fast changing. Economies of scale due to the massive plant capacity of standards may no more be relevant in fast changing scenario. Present quality standards turned out by existing facilities may no more be attractive to customers. Escalation in cost of materials, cost of labor and processing may be the cause of concern for viability of current technology. Even the spiraling cost increase of waste disposal under legal compulsions at times may threaten discarding the whole plant. Instead of quoted attributes acquired through historical cost, what is more relevant is how well the technology does function to meet the demands of the ever-changing scenario.

Considerable efforts have been made in the past to assess the underlying technology of the plant and infrastructures based on the performance measure particularly in the fields of health care, chemicals, and information processing [1]-[9]. In fact, thirty years old the Office of Technology Assessment (OTA) of the US Congress has become by now an authoritative voice to judge the appropriateness of a designed technology. The scale of operations of the plant is indeed a fundamental measure of performance as agreed to by one and all, but the design and operational parameters of the technology as considered in the performance measure may be really causal in nature, and may not reflect the end result performance [10]-[11]. What is important for any organization is to meet the requirements of customers in time with desired quality of supplies at an affordable price that contributes towards profitability and productivity of any organization. Again, flexibility of the technology base as focused by many [12] in the past is indeed crucial for sustained success, and growth of any organization. Besides the scale of operation and the resultant growth of business achieved in the market place, the effectiveness of cost management in terms of materials, labor and overhead are indeed important with the resultant profitability. Another area of technological impact is on the manufacturing cycle time and the effectiveness of logistics, and supply chain management. This affects the effectiveness of working capital management, and its consequent impact on return on investment. What is important is to reflect the total

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contribution of the technology base and its constituent building blocks towards organizational growth and development. Again, some businesses are technology intensive, and need huge investment outlay to start with. Some industries are in service sectors where technological developments are interwoven with human skills and organizational behavior. Rate of technological obsolescence also varies from industry to industry and thus the varying need for additional investments in technology to meet the challenges of market competition in different industrial sector of any economy. Thus, it would be interesting to examine the level of technology deployment in different organizations in different sectors in a growing economy and the impact they make on organizational performance.

II. Methodology Adopted

Level of technology adoption along with the given human resource base will govern i) the output, and the consequent service level, ii) the quality level of outputs and services, and iii) the cost level of outputs and services. All these three parameters will in turn govern the level of business achieved in the market place. The need for relative investments in technology to achieve the target sales will reflect the extent of capacity utilization of the technology base deployed. The effectiveness of cost management as governed by technology will result in the level of profitability achieved by any organization. Taking the impact of technology on the cycle time of manufacture and logistics effectiveness, inventory holding towards just-in-time philosophy could be an important measure of organizational performance in working capital management area. Again, on the other items of working capital requirement, the quality of technology adopted will govern the uniqueness of the product or service which will in turn result in the credit policy decisions and the resultant holding of other current assets. In the liquidity management area, technology now-a-days has a strong role to play. Maintaining an optimum cash and bank balance no doubt depends on the effectiveness of management information system of any organization which is an area where technology has really taken a big leap forward. Thus, the impact of technology on organizational performance has been measured here by the following parameters. The building blocks of impact of technology on organizational performance are reflected as in the Fig.1.

1. Level of business achieved, i.e., annual sales amount,
2. Level of capacity utilization, i.e., technology turnover ratio,
3. Level of operational cost effectiveness, i.e., gross profitability percent,
4. Level of inventory holding, i.e., inventory turnover reciprocal, and
5. Level of holding of other current assets, i.e., other CA turnover reciprocal

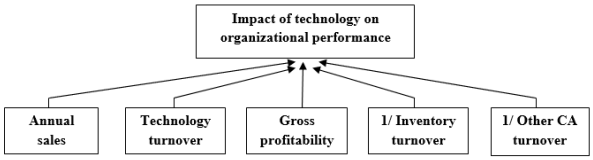

Fig. 1: Building blocks of impact of technology on organizational performance

III. Saudi Arabia and the Impact of Technology Deployment

The Kingdom of Saudi Arabia is at the heart of the Middle East/ North Africa (MENA) region, and one of the world's twenty largest economies. It is one of the fastest growing countries worldwide with per capita income of $26 000 in 2014. About 85 percent of exports and 90 percent of government revenues stem directly from the hydrocarbons sector. The Kingdom has not slowed its oil production since the price of oil began to decline in September last year amid lower global demand and increased supply stemming from shale and natural gas production. As a result, the oil sector is expected to grow by 1.72% while the government sector grew by 3.66%. The government continued its efforts to boost non-oil development through focused investment programs in education, infrastructure, health, social services, security services, municipal services, water and water treatment services, and roads and highways. In fact, non-oil industrial private sector GDP has been increased by 6.54% with outstanding growth rate of 6.70% in construction, 6.13% in transport, storage and communications, 5.97% in wholesale, retail, restaurants and hotels, and 4.46% in finance, insurance and real estate [13]. The success stories of such growth rates have indeed been the contribution of growth and development of science and technology as the priority area along with education, health care and e-governance projects. In fact, the National Science, Technology & Innovation (20-year) Plan (NSTIP) has identified fifteen specific technological areas for spearheading its economy on the technology driven path of progress.

In such a technology based economic scenario of Saudi Arabia, the present study attempts to examine the level of technology deployment in different organizations in different sectors as listed in the Saudi Stock Exchange to make an assessment of their relative impact on organizational performance. All 118 organizations belonging to 13 different sectors (as reflected in the Table-1) have been considered for the present study excluding the banking and the insurance sector listed companies. The net block of fixed assets as available in the annual accounts of all listed companies in the TADAWUL has been used to indicate the level of technology deployment. The chosen five organizational performance as reflections of technology impact have been used from the available annual accounts of listed companies in the TADAWUL. All figures have been considered based on the average of annual accounts of last four years from 2010 to 2013.

Table 1: Sector-wise Listed Companies in Saudi Stock Exchange Considered

Sl. No.	Sector	Abbreviation	No. of companies
1.	Agriculture & Food Industries	AGFD	16
2.	Building & Construction	BLDC	16
3.	Cement	CEMN	13
4.	Energy & Utilities	ENGU	2
5.	Hotel & Tourism	HOTL	3
6.	Industrial Investment	INDS	14
7.	Media & Publishing	MEDA	3
8.	Multi-investment	MINV	7
9.	Petrochemical Industries	PTRO	14
10.	Real Estate Development	RLES	8
11.	Retail	RTAL	13
12.	Telecommunication & Inf. Technology	TELE	5
13.	Transport	TRNS	4
	Total number of companies considered		118

IV. Results and Discussions

The level of technology deployed (based on last 4-years annual average of net fixed assets) adds up to MR761703 for all the 13 sectors together as reflected in the Table-2. The petrochemicals industries dominate with 42% of total technology deployment. Along with petrochemical industries, the two other sectors, energy and utilities with 26% and telecommunication and information technology with 12% together hold the lion share of 80% of total technology deployment in all the 13 sectors. In tune with level of 80% of technology deployment, these three sectors also hold 75% of total annual sales of MR531816 for all 118 organizations in 13 sectors as reflected in the Table-2.

Table-2: Sector-wise distribution of technology deployment and sales achieved

Sector	Technology deployed		Annual Sales	
	Total (MR)	Percent	Total (MR)	Percent
AGFD	22361	2.94	41003	7.71
BLDC	9299	1.22	22738	4.28
CEMN	20549	2.70	11704	2.20
ENGU	197695	25.95	33635	6.32
HOTL	2015	0.26	5413	1.02
INDS	41055	5.39	14907	2.80
MEDA	1909	0.25	636	0.12
MINV	10187	1.34	5321	1.00
PTRO	320205	42.04	286193	53.81
RLES	14522	1.91	5342	1.00
RTAL	18942	2.49	20137	3.79
TELE	93204	12.24	80903	15.21
TRNS	9760	1.28	3885	0.73
Total	761703	100.00	531816	100.00

With technological intensity of an organization on an average as the criteria for ranking (in terms of total technology deployed in a sector divided by the number of organizations in the respective sectors), the energy and utilities occupies the highest position as expected because of the huge investment base needed for both the organizations in this particular sector. The technological intensity based relative position of organizations on an average in different sectors is presented in natural logarithm scale in the Figure-2 with a maximum of 100 points for energy and utilities sector organization at the top of the scale Based on the relative investments in technology, petrochemical industries and telecommunication occupies the second and the third position on the ranking table with building and construction at the other extreme at the lowest position with a technology intensity figure of MR581 as presented in the Table-3.

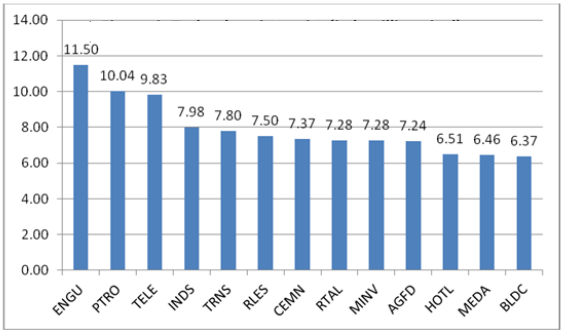

Fig. 2: Technology intensity (in million Riyals)

Table 3: Sector-wise Relative Technology Intensity

Sector	Technology intensity (MR)	Tech. intensity Rating
ENGU	98848	100.00
PTRO	22872	23.14
TELE	18641	18.86
INDS	2932	2.97
TRNS	2440	2.47
RLES	1815	1.84
CEMN	1581	1.60
RTAL	1457	1.47
MINV	1455	1.47
AGFD	1398	1.41
HOTL	672	0.68
MEDA	636	0.64
BLDC	581	0.59

If we now look at average performance parameters of organizations in different sectors (as presented in the Table-4), we see that in tune with very high level of technology deployment in three sectors, the energy and utilities, the petrochemical industries, and the telecommunication and information technology, the level of sales in these three sectors occupies the top three positions with petrochemical industries as the number one, energy and utilities as the number two, and telecommunication and information technology as the number three. At the other extreme, organizations in the media and publishing sector being at the last but one position in technological intensity also has the consequent lowest figure for sales level.

Table 4: Average Performance Parameters of Organizations in Different Sectors

Sector	Annual Sales (MR)	Percent Gross profitability	Technology turnover	Inv turnover reciprocal	Other CA turnover reciprocal
AGFD	2563	19.09	2.33	0.40	0.22
BLDC	1421	19.61	2.76	0.31	0.20
CEMN	900	54.44	0.85	0.15	0.17
ENGU	16818	9.23	1.88	0.43	0.55
HOTL	1804	44.68	3.19	1.00	0.13
INDS	1065	27.32	4.08	0.28	0.18
MEDA	212	28.94	0.85	1.00	0.04
MINV	760	-61.83	26.24	0.65	0.07
PTRO	20442	23.33	0.69	0.50	0.17
RLES	668	61.07	5.65	1.72	0.09
RTAL	1549	24.77	2.96	1.43	0.64
TELE	16181	28.83	0.54	2.07	0.32
TRNS	971	39.44	0.53	1.32	0.24
Company avg.	4507	25.04	3.79	0.71	0.23

However, on comparison of sales performance in other sectors with technology intensity, no such direct positive relationship could be observed for linking with sales.

Similarly, other four performance parameters also do not reflect any relationship with technology intensity. To examine the same further, ranking of organizations with respect to each of five performance parameters are tested for any relationship with the ranking of organizations based on technology intensity through Spearman's Rank Correlation (as in the Table-5). The rank correlation shows there is no significant relationship between technology intensity and the five average performance parameters of organizations in different sectors.

Table 5: Rank Correlation between technology intensity with performance parameters

Rank correlation of technology intensity with	Sales	Gross profitability	Technology turnover	1/inventory turnover	1/other CA turnover
Coefficient	-0.46	-0.04	-0.32	-0.10	+0.40

Now, if we look at individual organizations, there are top ten technology intensive companies (as presented in the Table-6), Saudi Electricity Company is at the top of the table with technology intensity of MR197223. The top ten companies include 5 companies in the petrochemicals industries sector, 3 from telecommunication and information technology sector, 1 each from energy and utilities and industrial investment sector. These top ten companies hold 78% of total technology deployment of all 118 organizations as listed in all 13 sectors under study.

Table 6: Top ten technology intensive companies

Ranking	Name	Technology (MR)
1.	Saudi Electricity Co. (ENGU5110)	197223
2.	Saudi Basic Industries Corpn. (PTRO2010)	165392
3.	Saudi Telecom (TELE7010)	51153
4.	Saudi Kayan Petrochemical Co. (PTRO2350)	40348
5.	Saudi Arabian Mining Co. (INDS1211)	36625
6.	Rabigh Refining and Petrochemical Co. (PTRO2380)	29591
7.	Mobile Telecommunication Co. SA (TELE7030)	24063
8.	National Industrialization Co. (PTRO2060)	17768
9.	Yanbu National Petrochemical Co. (PTRO2290)	17034
10.	Etihad Etisalat Co. (TELE7020)	16714
Total		595912

On examination of the impact of such a high level of technology deployment (as presented in the Table-7), it is observed that these top ten companies build up 72% of total sales of all 118 companies. The gross profitability of these top ten companies averages to 30.71% which is higher by 5.67% compared to overall average gross profitability. As regards impact on inventory holding, performance for top ten companies has been 48% better as compared to overall position for all organizations together. However, capacity utilization of top ten companies (in terms of technology turnover) has been far below, only at 20% of overall average. Similarly, for other current assets holding also, performance of top ten companies has been only at 70% of overall performance of all organizations together.

Table 7: Performance Parameters of Top Ten Technology Intensive Companies

	Annual Sales (MR)	Percent Gross profitability	Technology turnover	Inv turnover reciprocal	CA turnover reciprocal
ENGU5110	31937	8.76	0.16	0.18	0.11
PTRO2010	179981	30.61	1.09	0.33	0.15
TELE7010	53104	57.74	1.04	1.95	0.18
PTRO2350	5560	3.54	0.14	0.29	0.13
INDS1211	3461	40.36	0.09	0.18	0.03
PTRO2380	53206	1.74	1.80	1.17	0.38
TELE7030	6390	45.87	0.27	4.37	0.17
PTRO2060	17940	30.57	1.01	0.23	0.16
PTRO2290	8533	36.02	0.50	0.42	0.16
TELE7020	21225	51.93	1.27	1.42	0.17
Average	38134	30.71	0.74	1.05	0.16

Correlation study results also confirm that there is no significant relationship between technology intensity with each of the five performance parameters for the entire data set of 118 organizations under study (as shown in the Table-8).

Table 8: Correlation of performance parameters with technological intensity

Correlation of technology intensity with	Sales	Gross profitability	Technology turnover	1/inventory turnover	1/other CA turnover
Coefficient	0.7452	0.0033	-0.0255	-0.0137	-0.0569

V. Conclusion

The study demonstrates that the level of technology deployment varies very widely from sector to sector. The technology deployment in three sectors, the energy and utilities, the petrochemical industries, and the telecommunication and information technology have been thirty one times higher than the average technology deployment in the remaining ten sectors. Consequent to that, the average sales of organizations in these three sectors has been fifteen times more than the average sales in other ten sectors. The top ten technology intensive companies that include nine companies from the top three technology intensive sector comprises of 78% of total technology deployment by all 118 companies, and as a consequence result in an average sales of 8.5 times higher than the average figure for all 118 companies together. However, other organizational performance parameters do not exhibit any significant impact of technology deployment. This may probably signal that the technology intensity has been the results mostly stemming to meet the need for basic technology investments required by the specific sector rather than subsequent investments towards innovations and up-gradation to further improve operational performance parameters. Of course, the study needs to take into account the skill set of human resource base deployment in tune with technology base to assess the impact of technology on organizational performance. Family business being the root of business organizations in Saudi Arabia, the entrepreneurial nature of management could possibly be included as an input for further study that may also be a strong contributor to performance parameters of different organizations in different sectors.

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Modeling Value at Risk of agricultural commodity while accounting for seasonality and weather using Extreme Value Theory

Xue Gong, Songsak Sriboonchitta, and Sanzidur Rahman

***Abstract*—** modeling extreme risk in returns accurately arising from volatility in agricultural commodity prices is of utmost importance for farmers, policy makers and other key stakeholders. In this study, we compare and contrast performance of Extreme Value Theory based methods modified to accurately model extreme risk and Value at Risk (VaR) of three agricultural commodities (USA corn, soybean and wheat) while taking into account seasonality and weather information. We use daily frequency data covering the period Dec 1987 to Sept 2011 (i.e., 6192 observations). We find significant presence of clustering of violations during the crop growing seasons. We also find significant influence of seasonality and weather on VaRs as expected. Based on a rigorous process of backtesting and loss function estimates, we conclude that our modified seasonal Peak Over Threshold (POT) models perform better during the growing seasons of the crops and equally well for the whole period as well when compared with conditional POT and Duration POT methods. We strongly recommend that one should take into account seasonality and weather information while modeling risk in agricultural returns in order to obtain accurate forecasts and avoid unprecedented losses in the future.

***Keywords*—** Seasonal Peak Over Threshold model, Value at Risk, Extreme Value Theory, Seasonality and weather, Agricultural commodity futures.

I. Introduction

EXTREME price volatility in agricultural crop markets can impose significant risk for the farmers. The strong influence of seasonality and weather variations on the volatility of agricultural commodities are found both in the theoretical literature and empirical studies (Anderson, 1985[1]; Bester, 1999[2]; Streeter and Tomek, 1992[3]; Sørensen, 2002[4]). Therefore, it is important to generate accurate forecasts capable of accommodating extreme movements in future prices that are further exacerbated by supply side shocks such as seasonality and weather variations in addition to common demand side factors such as recent drive to divert field crops to produce biofuels, export demand of field crops and so forth (Babcock, 2012) [5].

The use of Extreme Value Theory (EVT) has been instrumental in allowing such forecasts to be made with greater accuracy than was possible in the past (Rootzén and Tajvidi, 1997) [6]. The EVT was invented to describe behavior of extreme values (observed in the tail of a distribution). Since risk comes from the tail of a distribution, the further we go into the tail, the riskier is the return. The methods based on EVT are among the best candidates to risk management studies (Gilli KÄellezi, 2006 [7]; Marimoutou Raggad and Trabelsi, 2009 [8]; Vandewalle and Beirlant, 2006 [9]).

Value at Risk (VaR) is a standard measure in risk management analysis as it measures the maximum level that investors could lose given a certain type of return distribution (Duffie and Pan, 1997 [10]; Jorion, 2007 [11]). Therefore, estimation of VaR in agricultural return using EVT while taking into account seasonality and weather variability can provide an improved analysis of volatility that can be useful to farmers, policy makers and other key stakeholders alike.

Corn, wheat and soybean are grown regionally in the USA and they are dominated by persistent climate change over time (Stevens, 1991 [12]; Huang and Khanna, 2010 [13]). A number of studies in the past focused on seasonal growing pattern and volatility of crops and concluded that cycles of volatility do exist (Choi and Longstaff 1985 [14]; Kenyon et al., 1987 [15]; Seeley, 2009 [16]). Moreover, at the advent of the growing season, supply side information, such as, weather variation, causes price volatility to increase. Therefore, the phenomenon of seasonal price movements and volatile crop growing season calls for a modified EVT method to model risk in returns from agricultural commodities.

Given this backdrop, the main objective of this study is to model Value at Risk (VaR) for three agricultural commodities: USA corn, soybean, and wheat using EVT while taking into account the influences of seasonality and weather information. The contributions of our study to the existing literature are as follows: first, we test for the evidence of seasonality on extreme price movement using EVT based Peak Over Threshold (POT) method including correlation between weather factors and agricultural returns; second, we propose a modified seasonal POT model that incorporates seasonality and weather factors and apply this to estimate VaRs of corn, soybean and wheat futures; third, we evaluate performance of

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our three variants of modified seasonal POT models (quarterly, three-period, and two-period cycle seasonal POT models) with basic POT, Conditional POT-normal distribution, Conditional POT-skewed student t distribution, and Duration POT in providing out-of-sample accuracy of VaR forecasts using backtesting procedure; and fourth, we conduct performance evaluation of the same models by using lost function estimates.

The reason we focus our analysis on the three key agricultural crop markets of USA because these are vital for domestic as well as overseas economies. For example, USA is the largest producer of corn and soybean producing 32% and 50% of the world production, respectively in the early 2010s. Also USA produces 10% of the world's wheat and supplies about 25% of the world's wheat export. Corn, soybean and wheat are grown on over 400,000; 279,110; and 160,810 farms in the USA respectively, implying that risk associated with these crops are closely related to welfare of a large number of farmers (USDA, 2013) [17].

The rest of the paper is organized as follows. In Section 2, we briefly discuss the literature on seasonal volatility of agricultural commodities and the limited application of EVT methods on agricultural commodities to date. Section 3 provides details of the methodology. In this section, first, we provide a review of the POT methods. Second, we illustrate the problem of clustering of violations during the growing season of agricultural crops. Third, we present our modified seasonal POT model which takes into account seasonality and weather factors in risk analysis. Fourth, we demonstrate evidence of correlation between seasonality and returns to justify use of our models. Fifth, we also introduce two Condition-EVT based methods that are commonly used in the financial market to estimate VaRs in order to compare their performance with our proposed methods. And finally, we present the rigorous backtesting procedure as well as loss function estimation procedure to evaluate performance of the various models and select the best performing model. Section 4 presents the main results. Section 5 provides conclusion.

II. Review of Literature

A. Seasonal Volatility for Agricultural Commodities

Anderson (1985) [1] provides the theoretical foundation to analyze seasonal volatility trends, known as the state variable theory. The core of the argument is that volatility of futures prices is connected with physical commodities. For example, Anderson (1985) [1] states that: "For grains, total annual production is determined by acreage planted and yields. Yields in turn are heavily dependent upon weather conditions at certain times of the growth process. These crucial phases tend to occur at approximately the same times during the calendar year. Consequently, we would expect the resolution of production uncertainty to follow a strong seasonal pattern." (p.341) Moreover, since demand and supply for grains are interdependent, both uncertainty in supply and demand will follow a strong seasonal trend not only during the production season, but also for the whole year. Therefore, it is reasonable to assume that the volatility of agricultural crop has different distributions in each period.

Corn and soybean are mostly grown in the same areas of USA known as the 'corn belt' (these are Illinois, Indiana, Iowa, Missouri, and Ohio). The winter wheat is grown mainly in Ohio, followed by Arkansas, Illinois, and Missouri. The geographical concentration led scientists to believe that these three crops are dominated by persistent weather conditions (Stevens, 1991 [12]; Seeley, 2009 [16]). According to the state variable theory, volatility will be high in the growing season every year where a comparatively large amount of supply uncertainty will occur. The empirical studies also found that the USA corn, soybean prices have high volatility during the growing seasons as compared with other periods (Sørensen, 2002 [4]).

B. EVT based models

In the agricultural markets, the phenomenon of extreme price movements are increasing as a consequence of national energy policy, extreme weather conditions (e.g., droughts/ storms/monsoon), and variations in the nature of market functioning in different seasons. Also, the frequency of such volatility is increasing in recent years. VaR serves as an envelope of information such that the investor can evaluate best or worst situation (e.g., under 5% or 1% probability). In particular, VaR based on EVT method measures the quantile of the EVT-based distribution of gains and losses over a given time horizon. Recently, researchers widely used the unconditional EVT methods to forecast agricultural risk by estimating VaR (Zhang *et al*., 2007 [18]; Morgan *et al*., 2012 [19]).

Morgan et al (2012) [19] applied POT methods to estimate extreme financial risk measures for USA corn and soybean futures market. They compared estimated risk measures with the normal distribution assumption in terms of size and precision and found that extreme VaR based on the EVT approach are considerably higher than those obtained by assuming normal distribution. To our knowledge, only a few of literature exists which have used EVT based model to analyze agricultural risk (e.g., Morgan et al., 2012 [19]). However, it is important to investigate extreme behavior of agricultural returns and quantify the return levels associated with extreme events while taking into account the influence of seasonality and weather variability, which is not seen in the literature, and hence is a contribution of our work to the existing literature.

It is worth noting that the latest financial literature suggests that POT method produces inaccurate forecasting results especially during volatile periods (Marimoutou et al., 2009 [20]; Santos and Alves 2012 [21]; Bystrom, 2004 [22]). In order to overcome this shortcoming, we propose a modified POT method based on EVT that takes into account seasonality and weather factors during growing season of agricultural crops. The objective is to characterize the distribution of extreme returns in agricultural crop markets using this

modified seasonal POT model.

III. Methodology

A. The Extreme Value Theory (EVT)

The use of EVT enables us to model the tails of a distribution using asymptotic models. Frechet (1927) [23] and Fisher and Tippett (1928) [24] introduced the first approach called Block Maxima Method (BMM). This method is direct, which is modeling of the maxima (or minima) from equally divided blocks. They argued that without knowing the whole data distribution, any maxima (or minima) can be modeled into a Generalized Extreme Value distribution (GEV), which is a single form of three types of asymptotic limiting distributions (Coles, 2001 [25]). A major weakness of BMM method is that only one maxima is mechanically collected from one block. However it could be that there may be several observations in one block which are greater than maxima of the other blocks' or there may be a maxima in one block which is quite small compared with other observations in the series (Embrechts et al., 1997 [26]).

Therefore, in order to use more information in the tail, POT method was proposed. This method sets a certain high enough threshold u, and then models all observations which are greater than the threshold. Therefore, to model the excess return beyond the threshold, the conditional probability used is defined as follows:

$$F_u(y) = P(x_i - u \le y \mid x_i > u) = \frac{F(y+u) - F(u)}{1 - F(u)} \quad (1)$$

where u is the threshold and xi is the value of the ith observation.

Pickands (1975) [27] proved that the limiting distribution of $F_u(y)$ can be generated into the following Generalized Pareto Distributions (GPD):

$$H(y) = \begin{cases} 1 - \left(1 + \xi y / \sigma\right)^{-1/\xi}, & \xi \neq 0 \\ 1 - \exp\left(-y/\sigma\right), & \xi = 0 \end{cases} \quad (2)$$

where ξ is the shape parameter and $\sigma > 0$ is scale parameter. Another advantage of GPD as compared with the GEV distribution is that the unknown parameters are less (only two) in this case. Basically, the implication is that the maximum log-likelihood function will be easy to implement. The particular type of distribution in the GEV is determined by the shape parameter (ξ). For example, when $\xi > 0$ indicates a Pareto distribution, which is a heavy tailed distribution; $\xi = 0$ indicates an exponential distribution, e.g., normal distribution and indicates a Pareto Type II distribution, which is a thin tailed distribution. Since the financial return often exhibits heavy-tailed distribution, the evidences in the financial literature suggest that the Pareto Type I distribution is the best fit for returns, and their estimates ranges between 0–0.5 in the literature. To estimate the parameters ξ and σ, we fit the GPD to the excesses over the high enough threshold u. Later, to get empirical VaRp formula, we transform equation (1) into

$$F(x) = (1 - F(u))H(y) + F(u) \quad (3)$$

where $x = u + y$ and F(u) can be estimated empirically by $\hat{F}(u) = \frac{n - N_u}{n}$, Nu is the number of exceedances over the threshold u and n is the whole data. Therefore, we get the estimate of F(x):

$$\hat{F}(x) = 1 - \frac{N_u}{n}\left(1 + \hat{\xi}\left(\frac{x - \hat{u}}{\hat{\sigma}}\right)\right)^{-1/\hat{\xi}} \quad (4)$$

where $\hat{\xi}$ and $\hat{\sigma}$ are estimates obtained by the maximum likelihood. For $p > F(u)$, VaRp can be obtained as follows:

$$VaR_p = \hat{u} + \frac{\hat{\sigma}}{\hat{\xi}}\left[\left(\frac{n}{N_u}(1-p)\right)^{-\hat{\xi}} - 1\right] \quad (5)$$

The detail of this method can be found in Morgan et al. (2012) [19] and Coles (2001) [25]. In our study, we modify the POT method incorporating seasonality and weather factors to estimate VaR of agricultural commodities because it is more efficient than BMM, both in terms of its estimation mechanism (using a certain threshold instead of a single maxima) and the number of unknown parameters to be estimated (two parameters are estimated instead of one).

B. Clustering of violations during the growing season

One significant problem of POT to estimate VaR is relatively higher clustering of violations during volatile periods (Santos and Alves, 2011[21]). In case of agricultural commodities, such problem repeats every year where weather information during the growing season largely passed on to the price through market mechanism.

Since the period of growing season is a natural experiment ground for testing VaR estimations, we investigate how standard POT methods tackle this phenomenon of seasonality. To illustrate the severity of this clustering of violations problem during the crop growing seasons, we present one-day-ahead VaR forecasts with a rolling window of size 1000 by POT (the actual results of the VaR forecast is presented and discussed in Section 4 later). We adopt the daily return data of CBOT corn, soybean and wheat from 24th Dec 1987 to 23th Sep 2011. We set the threshold at 90 percent quantile, which is consistent with the choices made by McNeil and Frey (2000) [28] and Marimoutou et al (2009) based on simulation test done on financial data by other studies.

We first find out the violations and later count their occurrences during the growing season of each crop, and then we calculate the ratio between the violations which occurred during the growing season and over the total period (i.e., the whole year). The results of this exercise are presented in Table 1.

A number of observations can be made from Table 1. First, although the violation rate is quite high in both periods, it is very high during the growing season. Here we use VaR 0.95 as an example, which means that the true violation rate should be 0.05. But violations turn out to be much higher, especially in

Table 1.The Clustering of POT Method in Growing Season

	Period	Left Tail	Right Tail
Corn	Growing Season	128(0.097)	114(0.086)
	Whole Period	291(0.056)	320(0.061)
	Ratio	0.440	0.356
Soybean	Growing season	120(0.091)	102(0.077)
	Whole Period	286(0.055)	292(0.056)
	Ratio	0.420	0.349
Wheat	Growing season	88(0.066)	70(0.064)
	Whole Period	309(0.059)	324(0.062)
	Ratio	0.285	0.216

Note: the ratio means the violations in growing season divide by total violations; the number in the bracket is the violation rate in each period.

the corn series, where the violation rate is 0.097 and 0.086. Second, more than 40% of the violations in the corn and soybean series are realized during the growing season which constitutes only three months in a year. All the results point out that conventional POT method provides inaccurate forecasts although it still shows high VaRs. However, in the wheat series, the violation rate is low because the volatility in its growing season is not as high as corn and soybean. We also draw out the first 1000 VaR forecasts in both short (left-side tail) and long (right-side tail) positions and plot them against the real data which also shows that the violations largely occurred during the growing season of the commodities

C. The modified Seasonal POT method

The seasonality phenomena have been widely used in non-stationary data, such as flood, temperature and rainfall analysis (Coles, 2001; Allamano et al, 2011; Tramblay et al, 2012). In our study, the central aim is to capture the characteristics of agricultural future returns to improve accuracy of forecasting VaRs. Therefore, we compare and contrast various POT models to identify the best model by comparing AIC (Akaike information criteria) and BIC (Bayesian information criteria) information. We try out three POT models. The first model is the basic POT model, which is fitted to test the behavior of the tail of the distribution. The second model is based on the first POT model but with seasonality component added, which is a simple seasonal POT model that allows threshold and scale parameter to vary periodically over time. The third model is based on model 2 with weather covariates added in the growing season, (s(t) is the growing season). The data set used is the first 1000 observations from 1989/12/25 to 1993/10/25 for each crop series.

Model One: Basic POT method

Model 1 is GPD(σ, ξ) with constant 90% quantile threshold as we introduced in the last section. The result is presented in Table 3 which shows that the shape parameter is positive, implying that the data set of the three agricultural commodities are heavy-tailed. Therefore, it is reasonable to use the EVT to estimate VaR.

Table 2. Summary of Statistics in Three Periods

		Corn	Soybean	Wheat
Mean	Period 1[a]	**0.0916**	**0.0286**	0.0029
	Period 2	0.0124	0.0105	**0.0195**
	Period 3	-0.0353	-0.0019	0.0065
Std.Dev	Period 1[a]	**1.9432**	**1.7105**	2.1684
	Period 2	1.6827	1.5204	2.1684
	Period 3	1.7305	1.468	**2.3593**
Min	Period 1[a]	**-12.31**	**-12.74**	-10.33
	Period 2	-8.368	-16.73	-22.59
	Period 3	-10.2	-7.819	**-22.95**
Max	Period 1[a]	**10.89**	**7.45**	9.87
	Period 2	9.305	6.645	**22.58**
	Period 3	8.45	6.3	17.76

Note: a. Period 1 is the growing season; the number in boldfold text is the extreme value in three periods.

Model Two: Seasonal POT method

As discussed in Section 2.1 seasonality exist in agricultural commodity prices. In order to find the evidence of seasonality, we adopt three periods in our estimations: period 1 (main growing season), period 2 and period 3 which are not the main growing seasons. The summary statistics of the corn, soybean and wheat series in three periods are summarized in Table 2. The periodical movement in volatility of agricultural commodities can be found in Fig. 1, where we present the standard deviation for the last 22 years for the three crop series. The first point in Fig. 1 is period 1 and so on. We see that the standard deviation is always peak in period 1 (the main growing season), then go down in period 2 and further drop to the bottom in period 3. For the wheat series, the peak seems to appear regularly in period 2. In all, the seasonal change in volatility is quite clear from the all crop series.

Since seasonal changes are obvious, it is natural to assume that the threshold and scale parameter will also change periodically and the relevant POT equation changes to:

$$\hat{F}(x) = 1 - \frac{N_u}{n}\left(1 + \hat{\xi}\left(\frac{x - \hat{u}_{s(t)}}{\hat{\sigma}_{s(t)}}\right)\right)^{-1/\hat{\xi}} \qquad (6)$$

where s(t) refers to the stage of the periodic cycle at time t. The scale parameters of POT model are thus allowed to take on different values at different stages of the periodic cycle. However, we assume that the tails in different seasons have similar behavior, i.e., the shape parameter is constant over the year because it is observed that the AIC and BIC is quite identical in the model where shape parameter is time-varying.

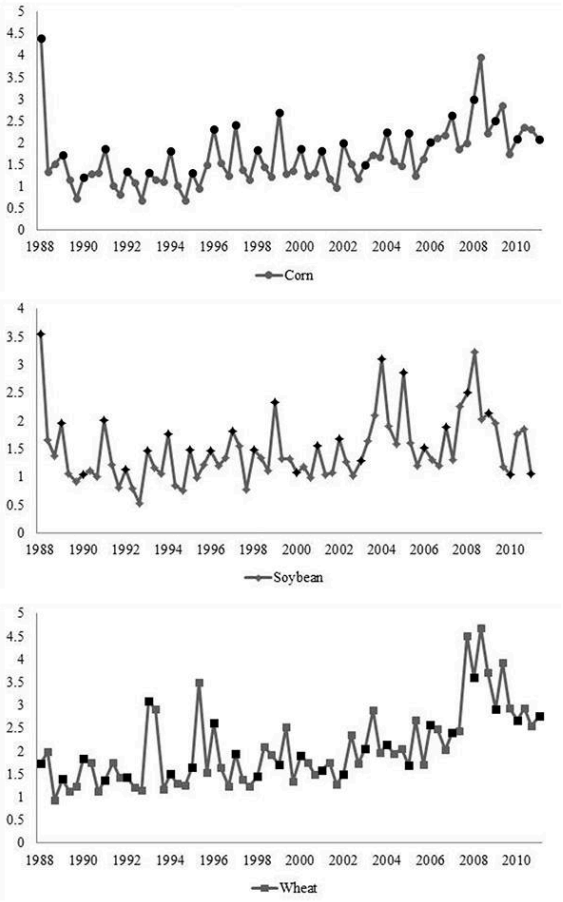

Fig. 1 The Seasonal Changes in Standard Deviation for Corn, Soybean, and Wheat Series

Define that s(t) = k during the k[th] season. In our case, s(t)=1 for period 1, s(t)=2 for period 2, and s(t)=3 for period 3. We estimate VaR as follows. First we select the period for the forecast and then calculate the VaR as:

$$VaR_p = \hat{u}_{s(t)} + \frac{\hat{\sigma}_{s(t)}}{\hat{\xi}}\left[\left(\frac{n}{N_u}(1-p)\right)^{-\hat{\xi}} - 1\right] \quad (7)$$

where $\hat{\xi}$ and $\sigma_{s(t)}$ are estimators of the parameters ξ and $\sigma_{s(t)}$. $\hat{u}_{s(t)}$ is set as 90% quantile of returns in the season. We sum up the log likelihood functions in each period, and maximize the log likelihood for the whole period:

$$\log L(\xi, \sigma_{s(t)}) = \log L_1(\xi, \sigma_1) + \log L_2(\xi, \sigma_2) + \log L_3(\xi, \sigma_3) \quad (8)$$

Note that each (t=1, 2, 3) is equal to log likelihood in POT method. All of the estimations are run in the R program, and the results are robust with different initial values.

The three-period seasonal POT model largely improves on the basic POT model. When compared with the first model, the AIC and BIC are much lower. The significant estimates provide strong evidence of a rich seasonal structure in each of the three agricultural commodity series (Table 3). Note that this model improves modeling of the tail of corn return: shape parameter of corn series is now significant. Another interesting finding is that the scale parameter is very high during the growing season than in other two periods. Hence, to further improve the model, we introduce some weather covariates into our model during the growing season. We have already seen that the return during the growing season is very volatile and also the basic POT model (Model 1) is quite ineffective: the violation rates are double than the true values.

Model Three: Seasonal POT method with weather covariates

Most corn and soybean in the corn belts are planted in May and harvested in October and November. A recent comprehensive study pointed out that the climate variables during June and August period have a significant impact on grain yield: high temperature reduces crop yield while precipitation enhances yield. Although there are mixed findings with respect to the effects of recent climate changes on crop yield such as temperature, the more recent researches conclude that there is a relationship between the weather factors and grain yields as well as volatility of grains (Almaraz et al., 2008 [29]; Huang and Khanna, 2010 [30]; Kucharik and Serbin, 2008 [31]; Greenstone and Deschenes, 2006 [32]; Schlenker and Michael, 2009 [33]).

The motivation for the presence of weather factors between excesses as covariates is mainly based on the relationship between the different grain returns and temperature (temp), precipitation (pcp) and drought index (drought). These three weather factors were taken from USA National Climatic Data Center (NCDC) monthly database. The drought index, short for Palmer Drought Severity Index (PDSI), is a measurement of dryness not only based on recent precipitation and temperature but also on hard-to-calibrate factors including evapotranspiration and recharge rates. This index is adopted due to the wheat series because it is highly correlated with drought index in our observations.

We plot the average weather variables for the states which concentrate on producing our chosen three grains against their returns (Figures 4). It is clear from Figure 4 that there are apparent dependencies between three weather variables: Temp, Pcp and Drought index and grain returns. Therefore, it is reasonable to modify POT parameters to include weather covariates. As Coles (2001) [25] suggest, the shape parameter is hard to estimate with time-varying parameters. Therefore, we only include weather factors into the scale parameter for the growing season as follows:

$$\log(\sigma) = \begin{bmatrix}1 & weather\ index\end{bmatrix}\begin{bmatrix}\beta_1 \\ \beta_2\end{bmatrix} \quad (9)$$

To justify the method in our case, we calculate the correlation of weather variables and returns for the first 1000 observations. The correlations between corn, soybean and wheat and weather factors: Temp, Pcp and Drought index are 0.346, 0.341 and -0.459, respectively. We found that including two or more weather indices in each crop series do not improve model performance. Hence, we select only one index from Pcp, Temp and Drought for individual crop series using Equation 9. Specifically, we include Pcp in corn, Temp in soybean and Drought index in wheat series.

The results of Model 3 are quite promising (Table 3). All the estimates of weather indices are significant in each crop series. All the AIC and BIC are lower than Model 2, implying that when the weather index is included, the model fits better to our data set.

Next, we briefly introduce two conditional-EVT methods which were successfully used in the financial markets. The purpose is to compare their forecasting abilities with our modified seasonal POT models in the results section in order to establish/justify our case.

Table 3 Results of Three POT Method

	Corn			Soybean			Wheat		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
σ	1.101***	-	-	0.953***	-	-	0.886***	-	-
σ_1	-	1.374***	-	-	0.979***	-	-	1.323***	-
σ_2	-	0.324***	0.334***	-	0.623***	0.676***	-	0.731***	0.750***
σ_3	-	0.567***	0.575***	-	0.567***	0.612***	-	1.135***	1.122***
ξ	0.198	0.366***	0.339**	0.017	0.022	-0.055	0.099	-0.040	-0.033
β_1	-	-	-3.024**	-	-	0.162***	-	-	0.727**
Temp	-	-	3.709**	-	-	-	-	-	-
Pcp	-	-		-	-	2.515**	-	-	-
Drought	-	-	-	-	-	-	-	-	-1.208*
Log-likelihood	-129.45	-80.81	-79.02	-96.95	-65.36	-63.43	-97.92	-96.75	-94.68
AIC	262.90	169.62	168.04	197.90	138.72	136.86	199.84	201.50	199.36
BIC	272.71	175.44	171.86	207.72	144.54	140.68	209.66	207.32	203.18

Note: *** represents significant at the 1% level; ** represents significant at the 5% level; * represents significant at the 10% level; the thresholds in three periods is u_{corn}= (2.891, 1.279, 1.508); $u_{soybean}$= (2.794, 1.412, 1.480); u_{wheat}=(1.422, 1.322, 2.137)

D Backtesting procedure for model evaluation

A best performance model can inform the farmers to allocate resource efficiently. The backtesting test is adopted in our study to test the reliability and accuracy of each method. Backtesting compare the out-of-sample estimated VaRs from different EVT based methods with the actual loss (Embrechts et al 1997 [26]). The procedure involves two parts: one is an exceedance test, which is based on an unconditional coverage test (UC test) proposed by Kupiec (1995) [35]. It tests whether the number of exceedances is consistent with the confidence level of VaR. Another is an independence test (IND test) which examines whether the violations are randomly distributed or have clustering. Christoffersen (1998) [35] combined the two criteria in one test, named conditional coverage test (CC test). Use of these tests will enable us to understand the model performance.

First, we can generate a hit sequence which is a binary series consisting of alternating one and zero values:

$$I_{t+1}(p)=\begin{cases}1 & if\ R_{t+1}>VaR_{t+1|t}(p)\\ 0 & f\ R_{t+1}\le VaR_{t+1|t}(p)\end{cases} \quad (13)$$

When the actual observation is greater than the estimated VaR, the violation happens. Therefore, the value in {I} is one. Let us define a conditional probability:

$$\pi_{ij}=P[I_t=j\mid I_{t-1}=i] \quad \text{for } i,j\in\{0,1\} \quad (14)$$

The conditional probability π_{11} represents a condition where the last period has a violation, this period also has a violation, and π_{01} represents a condition where the last period return has no violation, but this period has a violation. Since the CC test is a combination of two criteria, Christoffersen (1998) [35] explained that to evaluate interval forecasts is to examine whether the hit sequence $\{I_t\}_{t=1}^{T}$ satisfies UC property and IND property. The UC property can be written as $P[I_{t+1}(p)=1]=p$, i.e., $\pi_{01}=\pi_{11}=p$, which implies that irrespective of whether the next period value is violated or not, the ratio of exceedances should be the same as the confidence level of VaR. The IND property can be denoted by $\pi_{01}=\pi_{11}$, i.e., the last period information do not hold next period's information.

E Loss function estimation for model evaluation

We also introduce the loss function to double check the best method. Lopez (1998) [36] proposed a loss function to evaluate the VaR model. The main consideration is that when violation occurs, we need to see the distance between the actual observation and the estimated VaR. The smaller

the distance, the accurate is the model. Therefore the proposed quadratic loss function gives the best credit to the models, which obtains the smallest value:

$$\psi_{t+1} = \begin{cases} 1+(X_{t+1}-VaR_{t+1})^2, & \text{if violation occurs} \\ 0 \end{cases} \quad (15)$$

Note that inserting an integer value 1 avoids the special case where X_{t+1} is very close to the VaR_{t+1}.

I. Results

After we have proved significant influence of seasonality and weather covariates on grain returns, we now estimate VaR forecasts of corn, soybean and wheat using variants of POT models: basic POT, modified seasonal POT, Conditional POT and DPOT models. We present results of three seasonal POT models which divide the calendar year into two periods (s=2), three periods (s=3), and four periods or quarterly (s=4). We use the daily return data of CBOT corn, soybean and wheat from 24th Dec 1987 to 23th Sep 2011 which provides a total of 6192 observations. The growing season data is from 24th May to 23rd August for the corn and soybean, and 24th March to 23rd June for wheat. There are totally 5192 out-of-sample forecasts for the whole year and 1312 out-of-sample forecasts for the growing period. We choose time span starting from the end of 1987 because there are evidences to show that the USA government programs dominated market prices until 1988, implying that the grain prices may not reflect correct market supply and demand information until that period (Stevens, 2001). In finance, a long position means holder of the position owns the security and will profit if the price of the security goes up (right-sided tail), whereas the short position is the opposite (left-sided tail). To save the space, we only report results of the long position analysis.

A. Model evaluation using backtesting

The VaR forecasts of different methods for the growing season and the whole period of corn, soybean and wheat are presented in Table 4. The conventional POT model does not account for commodity characteristics, and is unable to produce correct violation rates and reject CC hypothesis both during the growing season and the whole period. For example, for the long position of corn and soybean series, the violation rates are equal to 0.087, 0.076 in the growing season, which is much higher than the expected 0.05. Moreover, most of the results in POT model is rejected by both UC and CC test criteria.

DPOT model performs well for the whole period, but not for the growing seasons, especially in the corn and soybean series. The violation rates are 0.073, 0.073 and 0.052 in the growing season compared with 0.056, 0.056 and 0.057 in the whole period. This is because the correlation between the duration and the excess is smaller in our dataset as compared to financial data series (Santos and Alves, 2012 [21]).

Conditional GPD models and seasonal GPD models perform very well when evaluated based on UC and IND criteria: the p-values of CC hypothesis of both methods are high in the soybean series. The seasonal GPD models seem to perform well in the wheat series, while the conditional GPD models are better in the corn series. The best performance of Conditional models for the whole period can be found in soybean series where we see 270 violations in 5192 out-of-sample forecasts, which is very close to the true violations of 260 (Table 4). During the growing seasons, the seasonal POT models perform clearly better than the Conditional POT models. Same good performance can be seen for the Seasonal POT(2) 66 violations in 1317 out-of-sample forecasts, i.e., the violation rate equal to expected 0.05 (Table 4). We rank the performances of different models in the bracket. Except for wheat series, in terms of the CC criteria all of the Seasonal POT methods rank higher than conditional POT method. Moreover, according to IND test results the seasonal POT models largely improve the clustering of violations problem in POT method. It is interesting to note that among the seasonal POT models, wheat series is more adapted to the three-period model; for the other seasonal POT models, the results is not so good, sometimes in the growing season the violation rate is higher than the whole period. However, for the corn and soybean series, the results are not sensitive to the selection of period cycle. The reason could be that wheat is grown in more wide locations in USA. Also, there are two different types of wheat harvested in spring and winter (Fleming and Ostdiek, 2006). The seasonal change in price of wheat is not as significant as changes in corn and soybean prices.

B. Model evaluation using loss function estimates

Table 5 shows the loss function results. We only provide the loss function results of models which have passed the CC tests in Table 4. The seasonal POT models achieve smallest values of the loss function for both the whole period and the growing seasons, which mean that in the seasonal POT models, even though there are violations, the forecasts are very close to the real values.

To sum up, all of our empirical evidences clearly show that our modified seasonal POT models, which account for seasonality and weather information, outperforms in modeling risk in returns for agricultural commodities for the growing season and also for the whole period.

II. Conclusions

The principal aim of this study is to estimate VaR of agricultural commodities using EVT method while taking into account seasonality and weather variation in our estimation procedure. In order to achieve this objective, we proposed a modified seasonal POT method that uses weather information as covariate for the growing season of the crops under investigation. The strong empirical evidences of seasonal volatility are presented. We also provide evidence of significant impact of seasonality and weather variables on the extreme price movement in corn, soybean and wheat. Our results indicate that all three agricultural commodity price series have a periodic extreme movement, and that the scale parameters of these series can

Table 4 Out-of-sample Accuracy for VaR(0.95) for Long Position

Model		POT	Seasonal POT (2)	Seasonal POT (3)	Seasonal POT (4)	Conditional POT-n	Conditional POT-sst	DPOT
Corn								
Rate	Total	0.06157	0.0643297	0.0625963	0.06414	0.0571484	0.057918	0.05599
	Growing	0.08663	0.0577069	0.0569476	0.05771	0.0607441	0.060744	0.07295
IND	Total	0.006	0.038	0.052(4)	0.035	0.799(2)	0.911(1)	0.488(3)
	Growing	0.325(7)	0.436(3)	0.401(5)	0.436(3)	0.668(2)	0.947(1)	0.362(6)
CC	Total	0.000	0.000	0.000	0.000	0.066(2)	0.037	0.117(1)
	Growing	0.000	0.334(2)	0.367(1)	0.334(2)	0.200(4)	0.219(3)	0.000
Soybean								
Rate	Total	0.05619	0.0562404	0.0562404	0.05605	0.051953	0.052723	0.0558
	Growing	0.07675	0.050152	0.0508732	0.05011	0.0577069	0.059985	0.07289
IND	Total	0.035	0.51(4)	0.51(4)	0.663(2)	0.131(6)	0.879(1)	0.638(3)
	Growing	0.031	0.743(2)	0.743(2)	0.698(4)	0.761(1)	0.553(5)	0.246(6)
CC	Total	0.014	0.103(5)	0.103(5)	0.132(4)	0.260(2)	0.661(1)	0.150(3)
	Growing	0.000	0.937(1)	0.937(1)	0.927(3)	0.431(4)	0.225(5)	0.000
Wheat								
Rate	Total	0.06234	0.0654854	0.0552773	0.06703	0.0569559	0.058688	0.05715
	Growing	0.05319	0.0676292	0.0661094	0.06687	0.0471125	0.053151	0.05167
IND	Total	0.016	0.093(5)	0.191(3)	0.066(6)	0.187(4)	0.454(2)	0.608(1)
	Growing	0.105(7)	0.676(2)	0.590(4)	0.632(3)	0.176(6)	0.723(1)	0.300(5)
CC	Total	0.000	0.000	0.097(1)	0.000	0.032	0.014	0.059(2)
	Growing	0.234(4)	0.018	0.032	0.0243	0.357(3)	0.864(1)	0.628(2)

Note: The p-value of the UC and CC hypothesis is given, and if the value is greater than 0.05, the model is adequate; the ranks among the competing models is presented in the bracket: the less the rank, the better model performs.

Table 5 The Results of Loss Function

Model		POT	Seasonal POT (2)	Seasonal POT (3)	Seasonal POT (4)	Conditional POT-n	Conditional POT-sst	DPOT
Corn	Total	-	-	-	-	836.916	-	1024.74
	Growing	-	251.702	**230.881**	237.334	319.915	308.811	-
Soybean	Total	-	463.689	467.338	**462.478**	619.144	629.363	757.73
	Growing	-	118.768	115.774	**111.67**	180.01	190.641	-
Wheat	Total	-	-	**1681.014**	-	-	-	2154.29
	Growing	338.87	-	-	-	**278.109**	307.67	289.697

Note: This table compare different model by the loss function; we only report the loss function value of the model which pass the CC test; models with the lowest loss values are boldfaced.

be better explained by accounting for seasonal information in the estimation procedure.

When further evaluated in terms of out-of-sample accuracy and loss function, we find that the seasonal POT models perform much better than the other models during the growing season, which are characterized by repeated high volatile period. Moreover, our seasonal POT models also show good performance when evaluated in terms of the loss function estimates.

Therefore, based on our results, we strongly recommend the need to account for seasonality and weather variability of

agricultural crops in forecasting risk and returns in agriculture because their impacts are significant and ignoring influence of seasonality will increase inaccuracy. The use of modified seasonal POT models, proposed in this study, provide desired improved accuracy of such forecasts and hopefully will enable farmers, policy makers and other key stakeholders to safeguard against unprecedented huge losses in the future.

Also, the key advantage of our modified seasonal POT method is its ability to capture the underlying characteristics of the commodity price movements. Therefore, use of this model is not strictly limited to agriculture-based data series. Our modified seasonal POT models can also be applied to any market which has a regular demand or supply side shocks, e.g., energy market, which is characterized by high volatility during summer and winter seasons.

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Risk management analysis for industrial projects performance

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***Abstract*—**This paper comprises the process description of the risk management topic and explains target and handling of the process. The process description addresses the project leaders, who have to evaluate and monitor the continuously risks and is placed under an obligation for all types of industrial projects. The local risk management strategies are intended to identify potential problems before they occur so that risk handling activities as well as mitigation actions can be planned and invoked as needed across the project's life cycle to proactively minimize their impact on the project. Subject of all risk management activities are risks for achieving the project goals (instead of more technical, product-related risks, which will be considered during a FMEA etc.). This process has a direct link to the project monitoring and control process, as all collected data have to be analyzed and reported there.

***Keywords*—**activities, process, project, risk.

I. Introduction

RISK management is absolutely essential in today's industrial world. The management of risk involves analysis, identification and quantification of the uncertainty and potential for losses in a specific investment project, and the implementation of appropriate management method to reduce or eliminate the potential process risk [1]. Risk fundamentally should be defined as uncertainty and not as the cause of uncertainty, so risk management should be based on the uncertainty of outcomes and not on the causes of risk. Defining risk as uncertainty might not be unique, but too often risk is defined as the cause of uncertainty and not the result of uncertainty [2].

The increased interest in and importance of risk management is being driven by many powerful forces due to increasing pressure on companies to invest resources in improving risk management [3], [4]. Most importantly, it is driven by the need for companies to manage risks effectively in order to sustain operations and achieve their business objectives [3]. Companies manage risks in a piece-meal fashion and struggle to effectively implement and manage complex strategic risks. A main goal of risk management is to manage all risks faced by a company: hazard, financial, operational and strategic risks [5].

In order to manage risk, a company needs to know what risks it faces, and to evaluate them. Identifying risks is the first step in building the organization's risk management [6]. It is advisable for companies to better adapt how to evaluate the risk management, namely by altering components to reflect a separation of risk and non-risk-related dimensions and by conceptualizing components on a broader level [7]. Managing risk in the manufacturing environment is critical and risks can only be controlled and monitored through understanding the structure and system of framework management methods [8].

Risks occur because we can never know exactly what will happen in the future [9], [10]. This uncertainty creates a gap between what really happens and what a firm has planned for and consequently causes losses due to the sequence of failures and/or causal events [9], [11]. However, as risk has the potential for loss, companies must assess the potential for a sequence of uncertainty and failures. The process of identification and assessment of risk involves understanding the conditions that give rise to potential problems, and then assessing the likelihood and negative impact of such problems [9], [12]. The result of this process will be information regarding situational risks upon which strategic management decisions can be made [9].

The use of derivative instruments for evaluate the risk management has grown dramatically over the past decades and so has the need to regulate the reporting method of these instruments [13]. A challenge in selecting risk management tools is that several methods are effective at cost risk, but not quantity risk, and bundling several product lines is effective when individual product risks exactly offset each other [14].

Risk management protects and adds value to the organization and its stakeholders through supporting the organization's objectives [15]. Product development projects are generally complex and fraught with risks which get magnified with the involvement of multiple processes [16]. Risk management process consists of all the project activities related to the identification, assessment, reduction, acceptance and feedback of risks. A source of risk is any factor that can affect project performance, and risk arises when this effect is both uncertainty and significant in its impact on project performance [17].

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II. Risk Management Description

A. Process Roles and Stakeholders

For risk management are involved the following roles:

1) Department manager is responsible for subordinate areas; has to approve project-specific changes of organizational default definitions for risk management as well as activities, which aren't solely in the responsibility of the project leaders.
2) Engineering process group (EPG) is responsible for planning and coordination of process development.
3) Project leader is responsible for managing a dedicated project; in this context responsible for the project-specific risk management activities and reporting.
4) Project team member has to support identification of project-specific risks.
5) Operational process owner risk management process is responsible for the process area risk management.
6) Project quality responsible is responsible for definition and implementation of project-specific quality activities; must not be independent according to the requirements for process and product quality assurance (PPQA).
7) Other identified stakeholders have to support identification of project-specific risks.
8) Quality manager evaluates and approves project-specific changes of organizational default definitions for risk management and reports these changes to the EPG and the operational process owner.
9) Risk responsible observes a risk and - if applicable - planned mitigation actions.

B. Inputs/ Outputs Process, Entry/ Exit Criteria

Inputs process include site-specific risk and mitigation strategy, site-specific list of typical internal and external risk sources (if existing), risk level assessment (if required), requirements list, project plans (e.g. project manual, quality management plan etc.).

Outputs process includes adapted risk list, risk and mitigation strategy (if necessary), risk list, for all critical risks appropriate mitigation actions are planned, project-specific status reporting.

Entry criteria process suppose: requirements are provided; stakeholders are identified and involved.

Exit criteria process suppose: necessary changes to the organizational standards for risk management as documented in risk list, risk strategy and risk mitigation plan are defined and approved; all risks are identified, analyzed and classified; all mitigation actions are reviewed; project-specific status reporting is distributed to the department manager, identified stakeholders, project quality responsible and project members.

III. Risk Management Activities

The risk management activities, shown in Fig. 1, are: initiate risk management, identify risks, and analyze risks, plan mitigations and track risks.

A. Initiate Risk Management

- Entry criteria: necessary input for assessing organizational default definitions available.
- Inputs: site-specific risk and mitigation strategy.
- Activity steps: establish risk management activities in the project. If necessary, adapt the default definitions as documented in the risk list template, risk and mitigation strategy (concerning risk parameters, classes, scheduling of risk management activities, reporting and – if applicable – risk acceptance criteria). In case of any changes to the defaults, communicate changes to the quality manager and department manager, who have to approve/release these changes.
- Templates/ checklists: risk list.
- Responsible: project leader.
- Stakeholder (and involvement): project quality responsible, quality manager, department manager, operational process owner of the risk management process and engineering process group (EPG).
- Outputs: if necessary, adapted risk list, risk and mitigation strategy.
- Exit criteria: all necessary changes to the organizational standards for risk management are defined and approved.

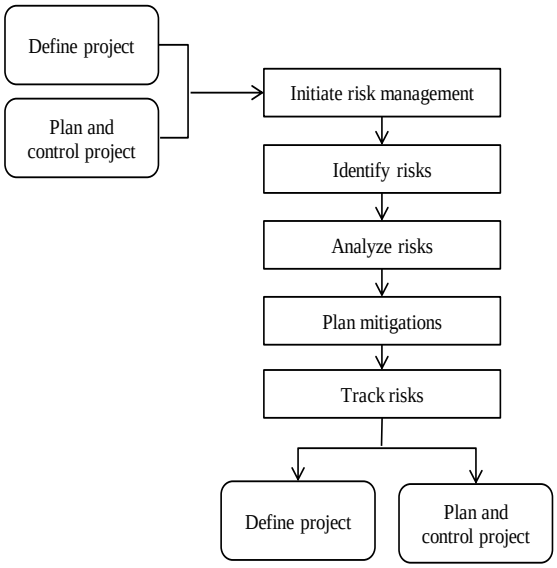

Fig. 1. Risk management flowchart

B. Identify Risks

- Entry criteria: no need additional information.
- Inputs: site-specific risk and mitigation strategy, site-specific list of typical internal and external risk sources (if existing), risk level assessment (if required), project plans (e.g. project manual, quality management plan etc.), and requirements list.
- Activity steps: identify project risks using the risk cause listing within the risk list, the initial/updated risk level

assessment (RLA) and the site-specific list of risk sources (if existing). Document the identified risks and attributes in the risk list and set risk status "open".

- Templates/ checklists: risk list, site-specific list of typical internal and external risk sources (if existing).
- Responsible: project leader.
- Stakeholder (and involvement): project quality responsible, affected project team member, identified stakeholders.
- Outputs: documented/ updated risks.
- Exit criteria: all identified risks and their attributes are documented in the risk list, risk causes and source list (if exist) are passed through completely, and no further risks identifiable.

C. Analyze Risks

- Entry criteria: all identified risks and their attributes are documented in the risk list.
- Inputs: documented/ updated risks.
- Activity steps (Fig. 2): copy the risk class (uncritical, substantial and critical) as defined in the last risk evaluation interval to the field "risk class of the past evaluation interval". Allocate probability and impact to the risks according to the defined scheme in the risk list. Document results in the risk list. Allocation of criticality will be done automatically by the risk list template.

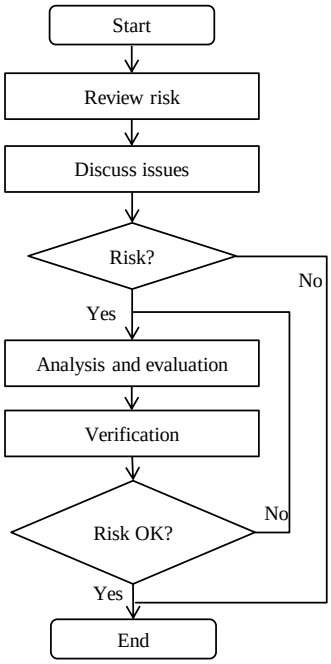

Fig. 2. Analyze risks flowchart

- Responsible: project leader.
- Stakeholder (and involvement): project quality responsible, affected risk responsible, affected project team member.
- Outputs: documented/ updated risk evaluation.
- Exit criteria: all identified risks are analyzed and classified and documented within the risk list.

D. Plan Mitigations

- Entry criteria: no additional information.
- Inputs: rated risk list.
- Activity steps: independently from risk classification the following definitions have to be done:
  - Specify a trigger (threshold) to characterize the condition, when a risk will change to a problem;
  - Define a responsible for at least observance of the corresponding risk and, if applicable, for the planned activities; by default and in case of a missing nomination, the risk responsible will be the project leader.

The following activities are mandatory for critical ("red") risks and optional for substantial and uncritical risks:

  - If applicable, define preventive mitigation actions to reduce risk probability beforehand.
  - If applicable, define reactive mitigation actions to reduce impacts and consequences in case a risk will change to a problem ("emergency plan").
  - At least, one mitigation action should be defined unless there is a documented decision to accept the risk (e.g. documented as a comment within the risk list or in general within a risk strategy document).
  - In case of more than one mitigation action prioritize the actions and select the most effective one (e.g. benefit-cost-analysis, should be documented as a comment in the risk list).
  - Review decision together with the department manager, if the resulting activities aren't solely in the responsibility of the project leader (e.g. concerning resources, budget etc.).
  - If applicable, schedule mitigation actions and transfer mitigation actions to the appropriate tracking tool (e.g. MS-project or open-point-list) with a link to the risk list/risk number.
  - Document decision in risk list.
- Responsible: project leader.
- Stakeholder (and involvement): project quality responsible, affected project team member, affected risk responsible, department manager (according to involvement in decision on actions).
- Outputs: documented mitigation actions.
- Exit criteria: for all critical risks appropriate mitigations actions are defined and planned.

E. Track Risks

- Entry criteria: risks are determined.
- Inputs: completed and updated risk list, documented mitigation actions, results from regular project controlling
- Activity steps: review regularly the risk assessment (e.g. within project meetings) according to the definitions documented in the risk list as well as risk and mitigation

strategy:

- Observe and evaluate triggers.
- Track taken mitigation actions and evaluate the impact/effectiveness; if it is obvious, that the intended impact/effectiveness won't be reached, stop the according activities and consider alternative mitigation actions.
- Update plan for mitigation actions in the appropriate tracking tool (e.g. MS-Project or open-point-list). If risks will no longer be considered as relevant, close risks by changing the status from "open" to "closed".
- Transfer risks that have changed to problems to the appropriate management tool and close the risk within the risk list by changing the status from "open" to "problem".
- Communicate the most important risks and the status of single mitigation actions in the status report (if applicable).
- Communicate the defined metrics in the project-specific status reporting.

- Responsible: project leader.
- Stakeholder (and involvement): identified stakeholders, project quality responsible, project team member, affected risk responsible, and department manager.
- Outputs: updated risk list, project-specific status reporting
- Exit criteria: all risks (and parameters/ classifications) were reviewed, and all mitigation actions and trigger were reviewed.

IV. Conclusion

The goal of the risk management process is to find defects and identify potential problems before they occur and prevent them from being incorporated in intermediate work products or even delivered to the customers, and to plan the necessary risk handling activities as well as mitigation actions. This process has a direct link to the project planning process as the identification of project risks is a part of the planning process; as first risk management activities are done during the risk level assessment (RLA), it has also a close connection to the product development process.

A risk management is an informal variant of conducting peer reviews on work products and is conducted on work products by the project leaders to identify defects for removal and to recommend other changes that are needed. The risk management process can be invoked at virtually any point in the development process and generally speaking, any work product can undergo a review. As far as effort and resources for reviews have to be provided within the project, this has to be regarded in the project planning process.

Primary risks refers to: insufficient resources for developing the project charter, insufficient transparency with respect to available resources/ budgets/ interdependencies/ when deciding on a new project, erroneous assessment of feasibility, unreasonably high expectations/goals (content, deadlines, project budget), vague measurement criteria, insufficient planning (or lack thereof) in regard to project contents, insufficient coordination with the departments that will be carrying out the project, and insufficiently qualified/ suitable project managers and team members.

Therefore, it is mandatory to measure the number of risks grouped by criticality, appearing problems, differentiated between expected and unexpected problems (i.e. appeared without being identified as risk beforehand), and allocation of risks concerning the different risk categories.

Acknowledgment

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Production Cost Reduction through the use of Information Systems: The IMMO Model[1]

Nelson Duarte, Carla Pereira

***Abstract*—**Production cost is an issue that is present in daily management. This paper addresses the issue of production cost reduction focusing in inventory optimization and waste reduction. The final goal is to contribute for firm´s competitiveness. In order to fulfill our goal we propose a conceptual model (IT supported) based in the traditional supply chain in the wood industry. This model (IMMO Model) will be supported by an information system that will optimize inventories management, and will also address the cutting stock problem (CPS). This model emerges from a research project in the wood industry aiming to promote efficiency along the production process. The methodology adopted consisted of a previous field research (in loco analysis) to identify the wood industry inefficiencies at the production level. Then it was identified that the main problems arose at cutting activities and waste generation from those activities. The inefficiencies identified in the cutting processes leaded to the identification of other inefficiencies at the stocking level. Once identified the main problems we went through the state-of-art in order to identify the main issues and solution approaches. After that it was possible to create draw a supply chain diagram. Considering the state-of-art on the supply chain (in)efficiencies and crossing it with the knowledge on the IT we will suggest a new diagram representing the IMMO Model. Along with the model we will explain the expected improvements at the supply chain in the wood industry. Those improvements will be achieved mainly through the development of algorithms developed under the operational research science that will optimize stock management and cutting activities.

***Keywords*—**Information Systems, Inventories, Optimization Models, Wood Industry.

I. Introduction

How do firms determine the ideal level of stocks? According to customers' requirements? Quantity discounts? Storage capacity? How much does the inventory represent on firms cost structure? The inventory costs vary from firm to firm and according to the activity sector. Some businesses are inventory-intensive, whereas others, just require a few office supplies. Anyway, inventories are essential, both at upstream and downstream levels. *"Typically, manufacturers located further back in the supply network incur an explosion of excess inventory and costs because they must carry additional safety stock to cope with added demand uncertainty, distortion, and lead time adjustments caused by the Bullwhip Effect [2]"*[1].

These effects along with operation costs (procurement, warehousing, non-fulfillment and information) represent a significant percentage of industry costs, leading to a more expensive final product, thus less competitive. This issue assumes a relevant role for decision making since in most industries, the prices are no longer defined by the function:

$$Price = f(Costs, Profit\ Margins), \quad (1)$$

Market competition led to a new equation where the dependent variable is no longer price but cost:

$$Cost = f(Price, Profit\ Margins). \quad (2)$$

This means that product costs (manufacturing and nonmanufacturing) are dependent on market prices (that tend to decrease due to competition) and profit margins (that are a key element for firm survival and success).

Manufacturing costs are classified into three types: (1) labor costs, (2) overhead costs, (3) material costs. The latter includes the inventory costs.

In order to become competitive, a firm must be able to reduce its production costs. Manufacturing costs assume an important role due to its weight on costs, and mainly due the necessity to control and reduce them. There are many ways to decrease production costs. In this paper we will focus in cost reduction, through process-performance, focusing in inventory and raw materials usage. By acting at the inventory level the results may present a wave effect through the production process. In brief this wave effect might be presented as lower quantity purchases, that leads to lees capital requirements, less warehousing needs, and less overhead costs.

In several industries such as the wood industry, the raw material needs a cutting operation in order to obtain smaller items to fulfill the demand or production requirements. This procedure is referred in the literature as a Cutting Stock Problem (CPS) and it arises mainly, due to the losses (trim loss) that occur during this activity. The waste generated from those losses also represents a cost. In order to minimize the trim loss it is necessary to optimize the cutting plan (consists of a series of cutting patterns with an associated frequency -

[1] The IMMO (Integrated Management Materials Optimization) project is an initiative of "Quadro de Referência Estratégico Nacional" (QREN), funded by "União Europeia/Fundo Europeu de Desenvolvimento Regional" (FEDER), through "ON.2 – O Novo Norte", through "Sistema de Incentivos à Investigação e Desenvolvimento Tecnológico".

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[2] Supply chain phenomenon presented by [38]

how many objects have to be cut with each pattern). By doing it, the waste will be minimized and a more efficient consumption of raw materials will be achieved.

An efficient raw material usage will reduce the acquisition and warehousing costs. Moreover, a larger amount of raw materials leads to a more complex decision making process. The workers (labor costs) must decide about (1) the best input for each item to be produced, (2) how to incorporate it in the process, and (3) the best cutting plan. This workflow is a time consumer that might lead to higher lead-times. Furthermore, even with economies of experience the trim loss might be quite significant. Reducing stock quantities, a firm is also reducing the number of options to cut materials, and saving decision making time, saving like this some labor costs (time usage). Reducing the amount of raw materials and decision procedures consequently the firm will also reduce overheads.

"*The stock size is optimal when the expected total costs of trim loss, warehousing, and non-fulfillment are minimum... A lower trim loss effect is also achieved if the stock is significantly less than the total order but in this case other costs such as the costs of non-fulfillment rise rapidly* [2].

The main question is how to perform the necessary savings to increase competitiveness, along the supply chain, without incurring in non-fulfillment costs.

According to [3] supply chains generally have two generic functions from which process-performance advantages can be gained in this regard—the production planning (inventory) and controlling processes and the distribution/logistics processes. With this paper is intended to present a model supported by an information system (IS) to contribute for improvements in terms of inventory acquisition and cutting optimization.

This model will be designated as IMMO – Integrated Management Materials Optimization – and is based in the lean methodologies (strongly related to inventory (re)organization), in this particular case lean manufacturing. The lean strategy that supports our model is presented in Table 1.

Table 1. Lean Strategy

Objective	To maximize customer value
General strategy	Focus on cost reduction and incremental improvements for existing products. Focus on waste and non-value added activities elimination, along the supply chain
Value chain strategy	Optimization of the flow of products and services through entire value streams that flow horizontally across technologies, assets, and departments
Inventory Strategy	Generates high inventory turnover and minimizes inventory needs due to more efficient usage, and reduces wastes through the supply chain
Lead time focus	Shortens lead-time only so long as doing so does not increase delivery or inventory costs
Manufacturing focus	Maintains high average capacity utilization rate
Product design strategy	Reduces the cost of production. At the same time it allows a more efficient response to customers' needs

Source: Adapted from [4]

Bearing in mind the lean strategy we intend with this paper to identify the main issues on production cost reduction focusing, as previously stated, in inventorying and raw materials usage. Since this model will be supported by an IS, we will also identify the role and importance of those systems in cost reduction. Based on the literature review we will suggest a model to optimize raw materials acquisition and consumption. In order to test the model, the wood industry was the chosen sector to focus during this project. The main objective is to increase competitiveness by decreasing production costs.

Having into consideration the Hardin's Tragedy of the Commons [5] and the concept of Sustainable Development [6], [7], with this model it is expected to present benefits on efficient production both in the economic perspective through the waste and dead stock reduction. At the same time it is expected lower capital needs. At the environmental level the benefits will arise, mainly by the reduction consumption needs (forestry wood). Those benefits will be achieved by transferring some decisions from humans (labor cost) to an IS that enables the optimization of purchases and materials consumption/cutting. With this model we expect to present a solution that is interesting not only at the firm level but also for their stakeholders.

II. Literature Review

A. Inventory Cost Reduction Models

Nowadays, either a firm is offering distinctive products or the main goal is to present quality products at a competitive price. In order to achieve this goal, it is necessary to approach the production system bearing in mind that managers can act mainly at the cost level [2].

At the inventory level, that represents a significant percentage of production cost in industry, there are several types of costs, such as fixed or variable, direct or indirect, but most of them fit in the classical operational costs (procurement, warehousing, non-fulfillment and information).

Sarkar & Moon [8] presented a table comparing the contributions of different authors about inventory models. As identified by those authors, cost related variables in inventory models are:

- Order Quantity; [9]
- Distribution Free Approach; [10]
- Setup Cost Reduction; [11]
- Quality Improvement; [11]
- Fixed Backorder Cost; [12]
- Variable Reorder Point; [12]
- Variable Lead-time; [13]
- Variable Backorder Cost; [14]

In the same work [8] is presented a mathematical model that considers all the identified variables but fixed backorder costs. By considering all these variables they obtained the minimum cost at the optimal values of the decision variables.

Other studies such as [15]–[18] suggest models to minimize inventories at different stages, or to optimize the purchasing quantities [9], [19]. That means that there is not only an entrepreneurial, but also academicals concerns about

production cost reduction. To reinforce it, there are several studies focusing in inventory models.

Going a bit further, if the inventory assumes this importance, it is also relevant to consider the activities that are consuming raw materials, in particular when they need to be processed before being incorporated in the production process. These activities may cause waste, long lead-times, over warehousing due to dead stock, or non-fulfillment costs. To avoid excessive production costs it is necessary to get information about all the activities, in order to take the best decisions at each stage. These activities are presented in fig. 1.

Another important and also explored issue in the academic world is the material waste, in particular those originated by cutting problems (trim loss). In the literature, as it was already mentioned, this issue is addressed as a Cutting Stock Problem (CPS) [20], [21] and assumes two basic groups of data: the information representing the stock of available objects (related to inventory minimization) and the information about the items that have to be obtained from the objects (CPS).

In SMEs in the wood industry, there is a lack of technological equipment and most of decisions are taken by human being (cutting activities, items to be incorporated, purchasing quantities, among others). That might be interesting when a firm is able to achieve economies of experience, but on the other hand, the risk of taking a second (or third) best decision may represent higher production costs. Under certain conditions such as uncertainty the human performance tends to be worst [22].

Considering the traditional supply chain, operational costs, and CPS, the industrial supply chain (namely in the wood industry) may be simplified into fig. 1.

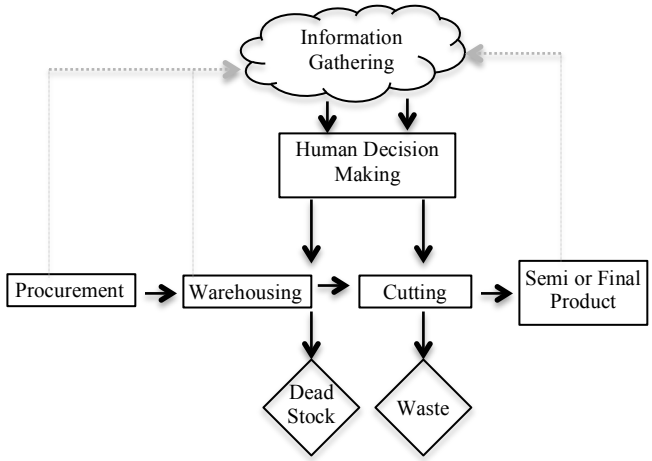

Fig. 1. Traditional Supply Chain Model

In fig. 1 is presented the typical supply chain process, where is possible to identify the emergence of dead stock, and waste. As previously mentioned dead stock and waste originates mainly from the non optimized cutting activities. These elements along the supply chain are somehow contributing for a higher cost in the final product (B2B or B2C). Moreover, the waste created during the process might be normal or abnormal, and the final product become more expensive independently from the accounting methods used for those records. Either spreading the waste costs over the final products, or posting it as loss for abnormal spoilage, at the end, firm's total cost will increase. Dead stock will also generate into waste or originate overhead costs for its maintenance.

All the identified costs might be higher or lower according to the decisions that are made along the supply chain. But when the decision is dependent on the human being, the results may not be the desired ones [23]. When it comes to decide what to buy, what to incorporate in the process and how to cut the materials in order the minimize the waste, each individual as a different approach [22], [24].

Considering the CPS and the inventory minimization as already suggested by [2] a lower trim loss effect might be achieved by reducing the stock quantities. However this policy increases lead times when it comes to choose the best items to cut for one particular production order, and the risks of non-fulfillment.

The problem of non-fulfillment costs could be minimized, for instance by information sharing. "*The retailer has an incentive to voluntarily share the information with the make-to-stock manufacturer if the magnitude of demand uncertainty is intermediate. This stands in sharp contrast with the existing studies, which show that the retailer never shares information when the manufacturer is make-to-order... While sharing information has a direct negative impact on the retailer—the informational advantage disappears, it has a positive impact by inducing the manufacturer to build up enough stock for the high demand market*" [25]. This solution in theory seems to be a good solution, however it requires a fully commitment and constant communication among the stakeholders along the supply chain.

In summary, the models discussed in the literature are important but most of them are focusing in specific variables, or issues along the supply chain. By identifying the main problems in the wood industry supply chain, gathering available information on the models discussed in the literature, and looking to the potential offered by the new technologies, we will try to redesign the traditional supply chain model, by using the information technologies.

B. Information Systems on Cost Reduction Models

"*Despite the often cited essay in the Harvard Business Review stating that IT doesn't matter (Carr, 2003), information technology plays an important role in many organizations. In our contemporary world, business environments have become global and there is a major challenge to deliver adequate computing services which meet stringent performance goals and operate at low cost"* [26].

Over de last years the role of IS has been important to help with the "*tremendous demand on companies to lower costs, enlarge product assortment, improve product quality, and provide reliable delivery dates through effective and efficient coordination of production and distribution activities…*

In the 90´s Enterprise Resource Planning (ERP) systems have emerged as an enabling technology, which integrates various functional (operations, marketing, finance) information systems into a seamless suite of business

applications across the company and thereby, allowed for streamlined processing of business data and cross-functional integration. Thus, ERP systems provide an enticing solution to managers who have struggles with incompatible information systems and inconsistent operations policies" [27].

"*The decision to implement an ERP system in a SME usually has a profound impact on the organization and on all members of the supply chain. The ERP implementation should be planned very carefully. The needs and business processes of the SME must be clearly identified and each business process meticulously documented. There must be a clear and documented understanding of the impact of an ERP implementation on each business process and on the supply chain. Modern ERP software is flexible and customizable and encompasses some of the best practices in a given industry. However, the ERP implementation team must understand its organization or client's business processes and create an implementation that is in harmony with the users. This is critical for SMEs, due to their particular characteristics*" [28].

According to [4] a critical aspect of successfully managing the supply chain lies in measuring and monitoring information about its key operational and performance parameters. It is therefore important for a firm to adopt IS that are aligned to its supply chain. That is, adopt IS that facilitate the particular processes of its supply chain and provide information about parameters that assess specific goals of its particular supply chain strategy. For instance, if minimizing inventory or achieving leanness is a key objective of the supply chain, what kind of applications should be adopted to support leanness in the processes? Or, which applications are required for effectively addressing the information processing requirements emanating from the objective of inventory minimization?

In order to fulfill the above requirements, the model that we are proposing (IMMO), results from a research project that started by the identification of the wood industry needs in terms of cost production reduction. This analysis allowed to identify that most firms do not use technological support during the production process originating like that high trim losses. Normally, when it is necessary smaller items, the most frequent is to get a larger item and to cut it into the required sizes. This procedure originates dead stock when the smaller, and frequently, not used items are stocked. Typically these smaller items either are immediately treated as waste, or will be classified as waste after a stocking period.

In order to improve productivity and contribute to a cost reduction strategy, the research team decided to develop a model that will be the ground zero for an IS that will be firstly applied in the wood industry. This model will focus mainly in the cutting optimization and inventory minimization contributing like this for a lean strategy in this industry.

However, according to [29] the effects of R&D in manufacturing industries on stocks appear within 4 years. "*Recent data shows a trend growth rate, measured as 5-year-moving average, of 3% annually. Simultaneously, the trend growth rate of labor productivity increased to about 4.5% annually compared to less than 3% in the eighties and the first half of the nineties. A similar development can be observed for total factor productivity. It is worth mentioning that this rebound in productivity growth is not limited to Germany or Europe. Similarly, maybe even more optimistic results are found for the US economy."*[29]. This time-lag on positive effects on productivity is also identified by [30] on what regards ERP's implementation.

The identified time lag on positive effects from R&D in manufacturing may also be justified by the type of benefits that derive from the implementation of computerized solutions. The effects are not direct, thus not immediately identified on firm results. This type of innovation according to the Oslo manual [31] can be classified into technological and process innovation. The innovation incorporated in the process by the use of IS, or in particular Manufacturing Execution Systems (MES) can be classified in incremental innovation that involve a reformulation or an amendment to existing products. This type of innovation differs from radical one, where the changes lead to a new and completely different solution from the existing ones [32]. In general the results from radical innovation, even though with a higher financial requirement, present a faster effect on firm results.

On what regards other ERP benefits [33] highlighted five accounting benefits: IT accounting benefits, operational accounting benefits (time and cost), organizational accounting benefits, and managerial accounting benefits. Other authors [34] argue that the interface between management control and information technology is an under-developed research area with a knowledge gap concerning its implications for financial performance. However the same study suggest that manufacturing plants will reap the greatest financial performance benefits from management control investments, when combined with information technology integration.

Even with positive results, the implementation of these systems, must be planned very carefully as argued by [28]. It is necessary to integrate these solutions, in particular the IMMO solution with other systems such as Material Flow Cost Accounting (MFCA) [35], in order to use all the relevant information to support decision making. The main advantage that we expect from this model is the intelligent use of information, based on historical data, but developing also predicting data models that will allow smarter purchases, a more efficient inventory organization, and better performances on producing activities. All these expected benefits would generate into a production cost minimization, promoting like that firm competitiveness.

III. IMMO Model

A. The IMMO Model

As it was previously mentioned, the main goal is to present a supply chain model, supported by an IS, focusing in wood cutting optimization and inventory minimization. This model will contribute for the development of a lean strategy in the wood industry.

Applying the theoretical concepts presented in Table **1**, we will start to present the model contribution for the development of a lean strategy (Table **2**).

Table 2. Lean Strategy supported by the IMMO Model

Objective	To maximize customer value reducing production cost → Lower prices, higher revenues
General strategy	Decision making supported by an optimization algorithm; Cost reduction through inventory and cutting optimization; Purchases optimization, lower stock levels, efficient raw materials usage.
Value chain strategy	The algorithm analyzes the best solutions from inventory, and best cutting plans (better items to be used for each production order)
Inventory Strategy	The algorithm will identify the best items to be used according to the production order needs, and will also help during the procurement process
Lead time focus	By transferring some decisions from human to a technological solution, the information on the best cutting plans will be faster and will promote resources optimization
Manufacturing focus	Efficient raw material consumption at the stock level and during the process
Product design strategy	By promoting production cost reduction it may allow to provide a higher quality service according to customer's expectations

In order to develop this model we will follow the traditional supply chain model (fig. 1) and to adapt it to the use of an IS as presented in fig. 2.

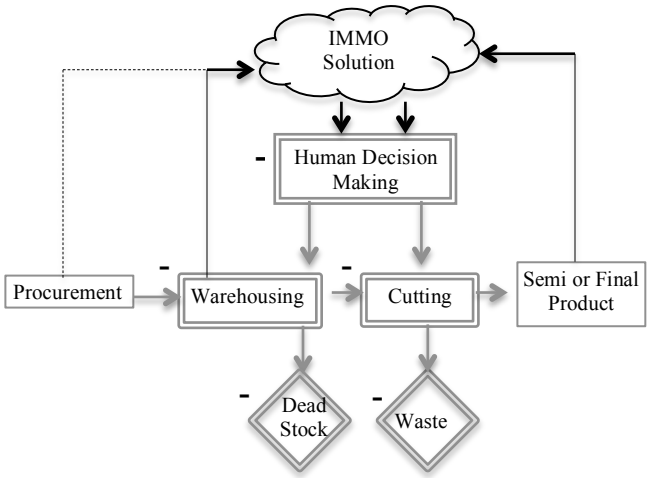

Fig. 2. Supply Chain (IMMO Model)

The IMMO Model intends to present a solution that has the flexibility to be connected to any Enterprise Information System, in order to optimize the quantity stocks and minimize the waste generated by the cutting activities in the wood industry [4]. By achieving these two objectives, a third one is achieved: the warehousing minimization. Consequently, it is expected a production cost reduction.

By getting all the information in an IS, another advantage is the chance to extract interesting information for the accounting system, in particular to management accounting, that is a powerful tool for decision making. Real time information about inventory, production and costs helps the managers' in their decision process. The accumulation of historical data about the characteristics of the purchased items, the output requirements, the cutting activities, and above all the integration into optimization models of these data will also allow to identify future production patterns and to suggest purchasing and stocking strategies for an efficient inventory management.

B. The Model Step-by-Step

Considering the model presented in fig. 2 we will now discuss the advantages of this solution. From fig. 1 to fig. 2 it was replaced the information gathering by the IMMO Solution. This means that instead of dispersed information that is normally gathered when it is necessary to make a decision, all the production process information will be collected by this solution [28], [29]. This data collection might be done automatically or manually depending on the firm's computerization level. By gathering all the information in an IS, the output (information) will take into consideration all this data, combining backward and forward information, requirements and restrictions. These outputs will be based in optimization models from operational research in order to help on the decision making process. Once we will get optimal, or near optimal decisions from an IS the human factor on decision making will be less relevant along the supply chain [23]–[25] as it is represented in fig. 2 with the dash symbol (-).

The reduction on human decision-making does not mean that the human factor is completely excluded from the process, since they must approve the computer-generated solutions. However, computer information processing capacity is able to consider higher volume of data, is faster, and will continuously be looking for an optimal solution. In fact, this solution is close to a Manufacturing Execution System [36] but minimizing the gap between the system and the practices that are done in firms, improving, however, those practices to promote productivity.

The optimal solution will consider at first the best cutting items available in firm's stock, regarding the expected output (smaller items) [20], [21]. By providing this information on the best cutting plans it will be possible to reduce the lead-time on this process [4].

By making a better use from raw material there will be a decrease in the waste (smaller items that result from the cutting activities and are not suitable for production) [4]. Sometimes these smaller items are restocked which leads to an over warehousing. When we optimize the cutting procedures, it is possible to reduce the number of items in stock, thus it is also expected an inventory and lead-time decreases, by the application of the IMMO Model [37]. The cutting optimization process will also lead to a reduction in the number of smaller items that are normally stocked in order to be used later, since they are not considered as waste after the initial cut. By reducing the amount of those items firms are also reducing dead stock. Most of times those smaller items

are not used any more. If those items are correctly organized and cataloged they will be just dead stock. Normally employees pick a larger item and cut it on the sizes that are needed at the moment. By having a system that firstly minimize those smaller items in stock, and identifies those smaller items, when they are necessary (according to the output requirements) the system will let the user know that an item with the necessary size exists in stock. This will promote the incorporation of that item in the production and will eliminate it from stock. Sometimes this smaller items even not presenting the exact needed sized is the best option to be incorporated. That might happen because those smaller items require less cuts and the leftovers might be waste and not dead stock.

With this model we aim to reduce production costs, by promoting a lean manufacturing strategy. The cost reduction will be promoted in a first stage through a more efficient usage of the raw materials (wood). Secondly, efficiency will also promote a lower level of inventory that reduces the capital investment in raw material, and overhead costs that occur due to the stocking activity. Taking the model a bit further and being more ambitious it can promote a third stage of efficiency at the procurement level. The IMMO model also intends to integrate an external perspective. Information sharing in order to minimize stock quantities, but enough to fulfill the market demand [25] could be done through the dashed line. The main idea is to perform an external integration with suppliers (and customers) in order to identify the best items on supplier stock, approaching thus the just in time methodology, both at input and output inventories.

By processing the information about the available input items, and output requirements, IMMO solution will also generate information about the best items to have in stock. Since this integration means information sharing, we shall not assume in advance that it will happen in the reality. It is possible, but it will depend on firm and stakeholders (partners) willing. However, by the implementation of web searching engines (not predicted as the standard solution, but possible to implement for specific users) it will be possible to have a constant search on the best web solutions for raw materials. However, even presenting it as a possible solution we believe that historical information about suppliers, such as quantity discounts, seasonal prices and/or delivery times, introduced in the system will be more efficient and cheaper than a web searching engine.

This model is presented, as a base for a further research in operation research field to find the best model to meet the wood industry needs in terms of process-performance, and production cost reduction.

IV. Conclusion and Further Research

In this paper were analyzed the main inefficiencies that contribute to unnecessary production costs in the wood industry. At first, was taken a field research by visiting some firms acting in this sector. During this activity it was possible to identify the main inefficiencies along the production process. Those inefficiencies were also identified by some studies in the academic field. The main issues identified were: (1) waste creation (trim loss) due to cutting activities; (2) poor inventory management due to purchasing policies and non-optimized materials consumption. This poor management leads to (3) dead stock warehousing; most of those inefficiencies occur due to a lack of technological support. (4) The lack of technological support transfers the decision making process to work-people (human being). (5) In turn, work people decision originates longer lead-times. All together (even less relevant inefficiencies) promote a higher production cost, through material, labor and overhead costs.

In order to reduce, or even eliminate these inefficiencies, we suggest a new supply chain model designated as IMMO Model. It intends to reduce the human decision making by transferring it to an IS (IMMO solution). This system intends to present a solution that has the flexibility to be connected to any Enterprise Information System, in order to optimize the quantity stocks and minimize the waste generated by the cutting activities.

By adopting this solution efficiencies will emerge at optimizing stock management, and cutting procedures. This optimization will lead to less inventory needs (capital savings), lower lead-times, lower overheads and lower labor cost. Moreover, the implementation of this solution by optimizing the cutting activities will reduce waste generation as well as dead stock (smaller items that hardly will be reintroduced in the production process).

The model itself includes two perspectives: internal (Stock management and cutting activities) and external (model development) by integrating suppliers' information (Procurement) in order to optimize the purchasing activities. At that step, purchases orders must consider not only the external price, but also conditions offered, and materials efficiencies during the cutting activities.

This external perspective opens up new research possibilities in management and IS sciences. The main goal, in the future, is to integrate in the model, information from raw material prices, availability, discounts, delivery times, among others, in order to find the optimal solutions to order raw materials. At the management level it will be necessary to identify the best Procurement practices, and then to design a system to get those decisions powered by a *computer brain*.

At the management level it is also expected to test the savings achieved by the firms that adopted the IMMO solution. For those firms it will be designed a study in order to compare the raw materials costs and productivity during a period before and after IMMO implementation. By doing this analysis it might be possible to conclude about the efficiency of this model.

However this study might need some time to be taken, according to the literature the positive effects from R&D in manufacturing present a time lag of 3 to 4 years. We believe that this model will promote efficiency in a shorter period, but there is also another issue to research about in the future.

Further, and once identified the percentage increase in

use of raw materials (wood), it will also be possible to develop new models for other industries and compare the results on raw materials efficiencies. From industry to industry the raw materials and the processes are different, however, we believe, that is some changes in the model, and a good scientific support, it will be possible to promote efficiency at raw materials usage in several industries.

Since this is a continuous improvement process we believe that with the application of this model further research might be needed in the specific issues of our model.

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Factors Affecting Work Life Balance of Medical Professionals

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***Abstract*—** Work life balance is crucial to employee retention and sustainable organizational performance and growth. After review of literature, the researchers could not come across many studies on work life balance of medical professionals in Saudi Arabia. The objective of the study is to understand the factors influencing work life balance of medical professionals and organizational climate in Government and Private Hospitals in Riyadh, Kingdom of Saudi Arabia. Hypotheses are framed to study if there is any significant association between type of organization (Government/Private) and sufficient facilities for relaxation, job satisfaction, stress at work, spending time with family, professional work often disturbs personal works, and work life balance.

In consultation with the medical professionals, a structured questionnaire is being designed with 42 questions and administered to the medical professionals in the Government and Private hospitals in Riyadh. Doctors and nurses of Government Hospital (32) and private hospital (46) are considered for the purpose of the study. Research methodology is designed to provide insights for policy makers to add value to the employees and hospitals in the Kingdom. The results indicate that hospitals should have empathy with medical professionals and aid in providing work life balance. Suitable organizational climate, infrastructure, facilities and incentives for additional work can reduce stress and enhance work life balance which in turn will add value to the health care of citizens and enhance their confidence in the health care system and satisfaction.

***Keywords*—**Job Satisfaction, Work Life Balance, Infrastructure, Medical Professionals.

I. Introduction

The Ministry of Health, KSA is spending billions of Saudi Riyals and is seriously interested in taking good care of the health of the citizens. Human capital is vital to timely treatment and level of satisfaction of the patients and their dependents. It is easy to buy technology but not attitude to serve the needy and the nation. This study is aimed to understanding the interventions to enhance the work-life balance of medical professionals, so that policy decisions can be taken to add value to the quality of life of citizens of KSA.

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Medical professionals are facing ethical dilemma when it comes to work life balance and feel stressed at work. This will have adverse effect on the level of satisfaction of the patients and their dependents. The doctors are also worried about gaining new knowledge and learning new techniques.

Further, there is increasing stress with reference to their future growth in their careers. There is an increasing trend of burnout (losing interest in the profession) among medical doctors due to various reasons. This study is focusing on factors influencing work life balance of medical professionals in Riyadh, Saudi Arabia, to sustain interest in the profession.

II. Literature Review

The concept of work-life boundary can better be understood as a process of creating and maintaining more or less "distinct territories of the self [1]. WLB has important consequences for employee attitudes towards their organizations- as well as for the lives of employees [2]. A research study recently conducted in Saudi Arabia [3] has indicated that the emotional exhaustion in Saudi Arabia (2.72) was higher than both US (2.69) and Romanian (2.21) studies. It may be noted that emotional exhaustion is considered the core manifestation of burnout. Depersonalization (impersonal response towards patients) score among Saudi Doctors (1.86) was higher than Romanian score (1.4) and less than US score (2.6). Further Saudi Arabia emergency doctors have comparatively lower personal accomplishment score meaning they deserve attention as there is a higher risk of changing specialty or employment by this group.

The work-life balance may be important in the management of the highly-skilled workers for instance technical professionals whose commitment may be a challenge to the employer ([4]; and [5]). While looking at the work and life aspect of doctors it is rightly be said that a professional is married to (usually) his/her work [6]. It's very hard to separate work from non-work activities in case of doctors. Piotrkowski [7] explained that work and life are 'integrated' rather than 'separated' for a typical software professional. In the discussion of work and life of employees working in some organization it is not possible to ignore the other side of the picture that is employers, who are generally responsible for

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providing the employee with Work Life Balance opportunities/facilities. Employer strategies of 'respect', embodied for example in family-friendly policies, have already been shown to have positive outcomes for the job satisfaction of technical workers [8], as well as for organizational commitment, turnover and absenteeism [9]. On the other hand, negative spill over from work to non-work life i.e., emotional exhaustion, has been shown to adversely affect organizations in the form of low commitment and high turnover [10]. Previous researchers have found job insecurity to be negatively related to marital and family functioning [11]. When work interferes with family life it also reduces the satisfaction from job and from life as a whole [12]. There are significant evidences that those working in construction industry are at risk of poor health and well-being due to long working hours, job insecurity, poor work life balance, low professional significance and temporary teams [13]. Work life balance defined by the New Zealand Department of Labor (2004) is creating a productive work culture where the potential for tensions between work and other parts of people's lives is minimized.

Job satisfaction can better be understood as the degree to which people like their jobs [14]. Employee turnover is an unavoidable factor in the organizations. Employee intention to leave is basically a signal to leave not the actual turnover [15]. Burnout is more common among physicians than among other US workers. Physicians in specialties at the front line of care access seem to be at greatest risk[16]. Six occupations are reporting worse than average scores on each of the factors – physical health, psychological well-being and job satisfaction (ambulance workers, teachers, social services, customer services – call centres, prison officers and police). The high emotional labour associated with the high stress jobs is discussed as a potential causal factor.[17]. Susan J. Lambert & Anna Haley-Lock demonstrated how an organizational stratification perspective can be useful for developing knowledge on the *nature* of inequality in the distribution of opportunities for work–life balance, and thus, for suggesting new avenues that enhance social justice in the workplace[18].

III. Research Gaps, Objectives and Hypotheses

From the above review of literature it may be observed that there are not many studies reflecting the work life balance of medical professionals in Saudi Arabia in general and Riyadh in particular. Hence the following objectives are identified for the purpose of the study:

- To understand the factor influencing work life balance of medical professionals in Riyadh.
- To understand the organizational climate in Government and Private Hospitals in Riyadh.
- To study if the employees are able to spare time for family and other activities they intend to do in their professional and personal life.

Following hypotheses are framed to study the above objectives:

H_0 1: There is no significant association between type of organization and hospital providing sufficient facilities for relaxation.

H_0 2: There is no significant association between type of organization and job satisfaction.

H_0 3: There is no significant association between type of organization and feeling stressed at work.

H_0 4: There is no significant association between type of organization and ability to spend time with family.

H_0 5: There is no significant association between type of organization and professional work often disturbing personal works.

H_0 6: There is no significant association between type of organization and work life balance.

IV. Research Methodology

The following methodology is being followed to achieve the objectives of the study. The conceptual scope of the study is limited to the human element in the health care sector directly dealing with the patient care. In particular the scope of the study is limited to the factors influencing work life balance of medical professional in Riyadh, KSA. A representative sample of medical professionals from Government hospitals (32) and Private Hospitals (46) in Riyadh, Saudi Arabia was considered for the purpose of the study. A total of 78 valid questionnaires were considered for the purpose of the study. The data are collected during May-July 2014.

Primary data are collected for the purpose of the study by administering a structured questionnaire with 42 questions to the medical professionals. For the purpose of review of literature and design of the questionnaire, secondary data are collected from sources like journals, books, official publications and websites of various hospitals in Riyadh, Ministry of Health and other relevant websites. A pilot survey was initially conducted. The responses are generalized with broad categorization and based on the data analysis of the pilot study the questionnaire was designed accordingly.

V. Data Analysis

One question with zero variance was deleted for the purpose of data analysis. Statistical Analysis of Critical Factors Affecting Health Care Sector in Saudi Arabia are carried out. Suitable statistical tools such as Cronbach's alpha, cross tabs, KMO Bartlett's test, Factor analysis - component analysis, scree plot, principal component analysis, crosstabs and tests hypotheses are conducted to draw meaningful inferences that would help policy makers and medical professionals to bring the desired change where necessary.

Table 1. Cronbach's alpha

Reliability Statistics		
Organization	Cronbach's Alpha	N of Items
Govt	.940	41
Private	.896	41

Scale Statistics				
Organization	Mean	Variance	SD	N
Govt	156.66	439.910	20.974	41
Private	141.26	304.064	17.437	41

Inference: Cronbach's alpha has been run for to check their reliability. The above table displays some of the results obtained. The overall alpha for the all items (Government and private group wise) are 0.940 and 0.896 respectively, these values are very high and indicates strong internal consistency among the given items in the questionnaire.

Factor Analysis: Before we proceeded for factor analysis, first the researcher tested the eligibility of the data by checking KMO- Bartlett's test which is a measure of sampling adequacy.

Table 2 KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.719
Bartlett's Test of Sphericity	Approx. Chi-Square	2277.813
	Df.	820
	Sig.	.000

The KMO value is > 0.5 indicates multivariate normality among variables. Further since the significance value is less than .005 the researcher proceeded with factor analysis.

The researcher calculated total variance, component matrix and extracted 11 components. Rotated component matrix using Varimax Kaiser Normalization rotation method which converged in 23 iterations. The PRINCIPAL COMPONENT MATRIX gave the component matrix which is rotated using the VARIMAX rotation technique which gives the ROTATED COMPONENT MATRIX. Rotation of factors helps in the better interpretation of factors. Since the first factor in the ROTATED COMPONENT MATRIX is heavily loaded with able to spare time for parents, elders in my (medical professionals) family, its factor loading value is 0.892. The second factor is heavily loaded with good and adequate infrastructure facilities at my work place (like water, sanitary facilities) its factor loading value is 0.909 and thus the subsequent factors can be interpreted based on their factor loading values. The final list of 11 factors which collectively account for 76 % of the variance in the data is given in Table 3.

Table 3. The final list of 11 factors which collectively account for 76 % of the variance

S.no.	Factor name	Factor loading value
1	Ability to spare time for parents and elders in my family	0.892
2	Good and adequate infrastructure facilities at my work place (like water, sanitary facilities)	0.909
3	Proud to be working for this organization	0.766
4	Counseling patient/ dependent to their satisfaction	0.883
5	Occupation demands time beyond working hours	0.770
6	Willingness to do social service	0.762
7	Comfort with occupational duty timings	0.777
8	Feeling stressed at work	0.881
9	Often having different demands on my time	0.751
10	job requires creativity	0.791
11	Turn down another job for more pay in-order to stay with this hospital	0.622

Table 4: Crosstab (Figures indicate % within Org)

Question	O	SD	D	N	A	SA	T
1. Hospital provides sufficient facilities for relaxation	G	6.2	3.1	34.4	37.5	18.8	100
	P	6.5	34.8	21.7	28.3	8.7	100
	T	6.4	21.8	26.9	32.1	12.8	100
2. I am able to perform my job to my satisfaction	G	3.1	3.1	31.2	28.1	34.4	100
	P	0.0	10.9	13.0	54.3	21.7	100
	T	1.3	7.7	20.5	43.6	26.9	100
3. I feel stressed at work	G	3.1	3.1	40.6	31.2	21.9	100
	P	4.3	23.9	37.0	28.3	6.5	100
	T	3.8	15.4	38.5	29.5	12.8	100
4. I am able to spend time with	G	0.0	3.1	21.9	40.6	34.4	100
	P	13.0	19.6	26.1	28.3	13.0	100
	T	7.7	12.8	24.4	33.3	21.8	100

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family							
5. My professional work often disturbs my personal life	G	6.2	9.4	28.1	25.0	31.2	100
	P	0.0	28.3	41.3	23.9	6.5	100
	T	2.6	20.5	35.9	24.4	16.7	100
6. I am able to balance work-life	G	0.0	6.2	25.0	28.1	40.6	100
	P	4.3	6.5	41.3	37	10.9	100
	T	2.6	6.4	34.6	33.3	23	100

Abbreviations:
G – Government Hospitals
P – Private Hospitals
O – Organization
SD – Strongly Agree
D – Disagree
N - Neutral
A – Agree
SA – Strongly Agree
T - Total

Table 5. Consolidated results of tests of hypotheses

Null Hypothesis	Sig. value	Result	Strength of Association
H_0 1: There is no significant association between type of organization and hospital providing sufficient facilities for relaxation.	.019	Rejected	0.389
H_0 2: There is no significant association between type of organization and job satisfaction.	.040	Rejected	0.359
H_0 3: There is no significant association between type of organization and feeling stressed at work.	0.062	Accepted	0.339
H_0 4: There is no significant association between type of organization and ability to spend time with family.	0.011	Rejected	0.410
H_0 5: There is no significant association between type of organization and professional work often disturbing personal works.	0.007	Rejected	0.424
H_0 6: There is no significant association between type of organization and work life balance.	0.032	Rejected	0.367

VI. Conclusion

The Government of Saudi Arabia is keen to provide the state of the art facilities for providing the health care to its citizens. From the review of literature it is being observed that there are not many studies reflecting the work life balance of medical professionals in Saudi Arabia in general and Riyadh in particular. This study is being carried out to understand the organizational climate and whether the employees are able to spare time for family and other activities they intend to do in their professional and personal life.

The results indicate that managements of the Hospitals should have empathy with the medical professional and aid in enhancing work life balance in terms of providing time for meeting aspiration of the employees. Good and adequate infrastructure should be provided. Facilities for drinking water and sanitation needs to be focused. Additional arrangements for counseling of patients / dependents to their satisfaction may be provided. Employees feel that their occupation demands time beyond working hours, expect comfort with duty timings and feel stressed at work. Further the job requires creativity. Hospitals can take policy decisions by sanctioning sufficient posts in departments where employees feel hard pressed for time and take steps to reduce stress and enhance creativity. An incentive plan may also be designed to satisfy the employees working overtime. The employees also have different demands on their time. They need time to spend with parents, elders and other family members. These subtle expectations may be fulfilled on humanitarian grounds. They are prepared to turn down another job with more pay in order to stay in the hospital they are currently working. This is a good sign of effectiveness of employee retention policies of the hospitals surveyed.

The results of tests of hypotheses with reference to sufficient facilities for relaxation, job satisfaction, ability to spend time with family, professional work often disturbing personal work, and work life balance, there is significant association with Government hospitals and private hospitals. With regards to feeling stressed at work there is no significant association with Government hospitals and private hospitals. Compared to private hospitals, Government doctors opined that they have sufficient facilities for relaxation, able to spend time with family, work life balance. Government doctors feel that their professional work often disturbs their personal work and feel more stressed compared to private hospitals. In spite of the above results surprisingly, less percentage of private hospital doctors (in comparison with Government doctors) feel that professional work disturbs their personal work and a higher percentage of private hospital doctors have more job satisfaction compared to Government hospital doctors and less work life balance. Hence Government hospitals may focus on reducing stress and private hospitals may focus of enhancing work life balance of their respective doctors and nurses.

Further studies may focus on a larger sample of Government and private hospitals to get a better picture for taking policy decisions at the national level. Future studies may also focus of department wise analysis to understand various factors influencing work life balance in respective departments of Government and private hospitals.

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Return on Investment Analysis (ROI) from "Sabbatical Leave" of Higher Education in Thailand

Marndarath Suksanga

***Abstract*—** The purposes and policies applied to sabbatical leave, along with the cost of using sabbatical leave. The potential benefits of the use of sabbatical leave to enhance organizational commitment are then examined. The focuses on the role of the sabbatical leave in the development, satisfaction, and productivity of faculty in institutions. An examination of the origin, definition, purposes, and outcomes of sabbatical leaves reviewed in the literature clarifies the role and benefits of the sabbatical leave. The result of this review can be used to determine the need for further study of how sabbatical leave might be used in higher education in universities level to the benefit of the faculty, students and organizations. The result of this review can be used to determine the need for further study of how sabbatical leave might be used in professional-technical and community colleges to the benefit of the faculty, students and organizations.

***Keywords*—** Return on Investment, ROI, Sabbatical leave, Higher Education.

I. Introduction

THE higher education system in Thailand started during the reign of King Rama V (1868-1910) with the creation of a law school, in 1887. This was soon followed by a medical school, the Royal Pages' School for training in government administration and an engineering school. By the Royal Decree of King Vajiravudh (Rama VI 1881 - 1925) on March 26, 1916, these schools were combined to form a university known as Chulalongkorn University. Thus Chulalongkorn University is Thailand's first institution of higher learning, officially came into being in March, 1917 [1].

The educational management in Thailand falls under the responsibility of many ministries and agencies. The Ministry of Education (MOE) is responsible for preprimary up to the higher education levels. It also provides non-formal education or out-of-school programs and supervises private schools at all levels except the degree level. The Ministry of University Affairs (MUA) is responsible for higher education at the undergraduate and graduate levels at both public and private universities [2].

The Challenges / Globalization and the Advancement / Science and Technology

In addition, there are other organizations involved in educational administration and planning at the national level; namely the Office of the National Economic and Social

Development Board, the Office of the National Education Commission (ONEC) and the Budget Bureau. Regarding personnel administration, the Office of the Civil Service Commission is in charge since all teaching and supporting staff in public educational institutions are government officials [2].

A significant shift in the country's development planning has taken place since the Eighth Plan (1997-2001), a shift from a growth-oriented approach to the new model of holistic "people-centered development." In order to ensure more balanced development, priority was given to broad-based participation that would actively engage civil society, the private sector and academia in formulating the national development plan.

T. W. Schultz. Schultz defined human capital as attributes of acquired population quality, which are valuable and can be augmented by appropriate investments and a many of the capabilities inherent in people. Carry both innate (Innate) or caused by the accumulation learn. Each person is born with a gene specific to the individual, which is an indicator of ability. These features are valuable features. This value is increased when there is a reasonable investment. Human capital has also been defined on an individual level as the combination of these four factors: your genetic inheritance; your education; your experience; and your attitudes about life and business. Human capital is important, because it is a source of innovation and strategic renewal, whether it is from brainstorming in a research lab, day-dreaming at the office, throwing out old files, re-engineering new processes, improving personal skills or developing new leads in a sales rep's little black book. The essence of human capital is the sheer intelligence of the organizational member. [3].

Human capital development is the process to enhance the potential labor force in terms of knowledge and skills. In order to achieve better performance, the latest Thai education ACT requires a professional development for all lecturers and professors. High quality of university would result in high quality graduates. Low quality universities often lack budget, and therefore have low qualification professors and staff, and insufficient technology and learning materials. The Thai Higher Education Committee [4] provides three important policies: 1) Both professors and staff must be able to work

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with full potential, 2) both professors and staff must be able to work with security and safety, and 3) both professors and staff must receive sufficient training to be able to provide a quality teaching system. Thai education institutions are encountering a challenging course of change in order to be an essential member of AEC in 2015. Therefore, it is imperative to prepare organizations and their employees to be ready for the ASEAN community [5].

So, Development the academic, mental, and knowledge management ability of students by encourage teachers to have education certificates relevant to the subjects they teach. A program to produce high quality teachers should be supported. A teacher training system should be undertaken to attract individuals who possess intellectual ability, morality, and a teaching spirit. Sector partnerships should be promoted to honor excellence in teaching and dedicated teachers as role models. Incentives should be offered to teachers for self-improvement, while the current assessment process should be improved to better achieve efficiency in education management and student development [6].

To provide quality education, it is critical that the professional-technical faculties in community colleges are not only well-trained, but also kept fresh and active in their fields of emphasis. One method of providing well-trained, fresh and motivated professional - technical faculty is the use of sabbatical leave. Sabbatical leave has existed in some form for many years. In English translations of the Hebrew scripture this period of rest is generally referred to as the Sabbatical Year, it has also been called the Sabbath Year, Fallow Year, Year of Rest and Year of Remission. This year of rest was originally created for the land [7].rather than for the people, but in allowing the land to rest it naturally occurred that the people received rest as well. Hebrew sabbatical practices were created to revitalize all people and land; in academics it was designed to revitalize faculty [8].

Sabbatical leave is viewed very differently by people at various levels of higher education. Some see it as a right; others see it as a privilege. The arguments range from the idea that everyone deserves a sabbatical at a regular interval whether they have a specific project in mind or not, to the idea that only tenured faculty with a legitimate, demonstrated need should be granted sabbaticals [7].

Sabbaticals give professors in general higher education the opportunity to pursue and refine their research interests, something which heavy teaching loads often prohibit [9]. The focus of sabbaticals for professional-technical faculty is focused on new and improved skills rather than research; but like those in general higher education, full teaching loads often prevent them from gaining these skills. The sabbatical leave allows for professional growth that should bring the faculty member back to the college or university with new and improved skills, published works or new methods of teaching. The ultimate beneficiary is the student [7].

II. Procedure for Paper Submission

A. What is return on investment (ROI)? Definition and meaning

Return on Investment' (ROI) is frequently defined in management and marketing literature as a measure of financial effectiveness concerned with returns on capital employed in (profit-making) business activities [10-12]. It is expressed as a ratio of income or earnings divided by the costs that had been applied to generate the income or earnings. In formal public relations nomenclature, the Dictionary of Public Relations Measurement and Research defines ROI as "an outcome variable that equates profit from investment" but does not attempt to classify a 'public relations ROI', other than as a "dependent variable" [13]. In public relations' practitioner parlance, however, ROI appears to be used in a much looser form to indicate the results of activity. In 2004, a report by the Institute of Public Relations in the UK1 defined ROI as "a ratio of how much profit or cost saving is realized from an activity, as against its actual cost, which is often expressed as a percentage" [14]. The report, however, added that, "in reality few PR programmed can be measured in such a way because of the problems involved in putting a realistic and credible financial value to the results achieved. As a result the term PR ROI is often used very loosely".

Return on investment (ROI) is one of the key methods used to quantify the level of success achieved or achievable in a business endeavor. The concept of ROI is used throughout private industry not only to determine past results, but also to evaluate the current situation and as a decision making tool for the future. The advantages of ROI are clear in that it provides the flexibility to anticipate output changes in advance. This benefit results in the ability to not only preview the future in a real world sense, but also to modify the inputs to the numerator and denominator of the equation to model potential courses of action for the organization.

B. How High Performance Work Systems (HPWS) Influence Organizational Outcomes

The values of leave systems, whether short or long; educational, professional or personal, date back to the late 1950's. Programs unique to emerging economies demanded continual change; consequently, changes in management styles to consider the quality of life, women in the workforce, and improved benefits were demanded [15]. While dated, the familiar Frederick Taylor's *Theory of Scientific Management*, one of the first theories of human performance and motivation, theorized that performance was based on piece-meal assignment and monetary reward. This approach analyzed employee value based on the design of the logistics of the work environment and their ability to produce within a specific time [16]. Employees of later, emerging economies wanted to be treated with dignity and respect as important to the success of the organization. Of this later era, expectations for employers to provide fair wages in addition to improved work conditions, training, and safety in the workplace in addition to benefits such as vacation time, continued education, family leave, retirement programs, and health insurance was demanded [17-19].

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Ramsay, Scholorios, and Harley (2000) mention the motivators for high performance work systems and motivators that are most likely to stimulate high-commitment or high-involvement employees. Approaches to measure the return on the investment of a myriad of systems seem to present limitations associated with subjectivity and the inconsistencies of humankind that make success, overall measurement of impact, and value to the organization difficult to analyze. Employees at the executive level tend to be high performance, high commitment, and highly involved in the mission of the company employing them; therefore, benefits such as sabbatical leave may indeed be an outlet for such employees to continue their education, use such leave time to take advanced educational classes or training, or use the time to rejuvenate.

Several systems and analyses are discussed in the literature [20-23]. However, a statement by Ramsay et al. (2000) sums the findings in each of the studies most succinctly in stating that there is a "consensus among those researchers who have reported a link between High Performance Work Systems (HPWS) and organizational performance measures that the associations reflect a causal link which flows from practices through people to performance. Explanations of how and why this link should work rely on theories of employee motivation in response to the types of practice described by HPWS theory and have become so embedded, especially in US management research, as to be taken largely for granted". The authors communicate that the effort to apply a complicated ROI system or strategy to understand and intricately track a leave system to a value metric is over doing the very simple fact that offering flexibility and leave benefits can be 'taken at face value, as employee-centered and empowering. Employees, in turn, find that their needs are met by the opportunities and benefits these practices provide, and respond by taking initiatives without instruction and showing loyalty and enthusiasm for their employer.

There is value in applying a model to understand the behaviors of high-commitment and high involvement employees, for which sabbaticals seem to be most effective. Most HPWS models involve a labor process critique as well as surveys using such systems as WERS98, gathered from employers and employees that permit them to rank or otherwise express their attitudes and satisfaction level with regard to their title, task assignments, need for responsibility, and desire to achieve. Models using labor processing (LP) evaluation, wherein input is measured in by output, is considered to ineffective [24].

C. The definition and purpose of the sabbatical leave

In *The Sabbatical Mentor,* Zahorski (1994: 24) provides both a traditional definition of the sabbatical leave as well as suggestions for additional characteristics to make it more contemporary [25]. He begins with Carter Good's (1959) definition: "[The sabbatical leave is] a plan for providing teachers with an opportunity for self-improvement through a leave of absence with full or partial compensation following a designated number of years of consecutive service (originally after six years)" [26]. Zahorski adds that faculty must be required to return to service after the leave and must file a sabbatical report. Although specific university policies may differ, the definitions found in literature of the last decade generally conform to the hybrid definition set forth by Good and Zahorski. Together, Good and Zahorski provide a definition that conveys the serious nature of the sabbatical leave. During the leave, some sort of faculty development is expected. Such compensation is only granted after a number of years of service to the institution. A report of activities must be filed after the sabbatical leave is complete to address productivity concerns. Further, the faculty member is expected to return to service after completing the sabbatical leave.

Sabbatical leave among academics is a special respite. Sabbaticals are paid leaves for personal and professional development [27]. According to Zahorski (1994), a sabbatical is meant to provide relief from routine work duties. Sabbatical is appreciably longer and less frequent than the respites studied to date. Furthermore, sabbatical is usually not work free. It entails work different in nature and often in a location other than the routine work site. Though sabbatees (individuals on sabbatical) can be expected to perform some parts of the job while on sabbatical (e.g., reading and writing), some of the stressors that characterize routine work (e.g., teaching) are diminished. Etzion et al. (1998) and Westman and Etzion (2002) found that even nonwork-free respites (reserve military service, business trips) provide relief from job stress. Hence, though not work free, sabbaticals may provide opportunities for renewal.

Sabbatical has been viewed historically as an opportunity for renewal and for mitigation of job stress. According to Zahorski (1994), sabbaticals typically engender new perspectives, renewed vigor, and better health. However, this topic has received little scholarly attention. Research has found that academics view sabbatical as a release from teaching and administrative duties and an opportunity to initiate new research, catch up on developments, and produce publications and novel discoveries [27]. Retrospective self-reports do instantiate resource gain and thus accord with COR theory. On the basis of COR theory, we measured resources such as professional knowledge and advancement, free time, energy, support, and goal accomplishment.

Sabbatical leave programs are typically competitive among faculty, allow for a semester-long fully-paid leave of absence (or a full academic year at half pay), and faculty members are eligible to apply every seven years [25]. The process of application varies dramatically based on institutional type and mission, with comprehensive institutions, for example, placing greater value on activities that are instructionally related as compared to research institutions that place more weight on activities that promote research activities or participation in programs that bring or potentially bring the institution soft money [26-27].

The process of sabbatical application, however, is not entirely based on rational decision-making, and has been alluded to be politically motivated [26]. Boening found at one case study institution that those sabbatical applications that had research funds or grants attached to them were much more likely to be approved than those that were more speculative or independent. He also found that faculty in the liberal arts, hard sciences, and businesses were much more likely to receive approval for sabbatical leaves than those in the social

sciences and education.

As noted earlier, the current existence and structure of the sabbatical has been challenged by both the public and higher education administrators. A primary difficulty for defending the sabbatical is an inability to measure or somehow quantify the benefits of sabbaticals in any particular area of faculty work. Following Douglas' article, there were several readers who quickly noted that the sabbatical has a residual positive impact on the institution [28].observed this in their 360-degree survey of the impact of a sabbatical, finding that "colleagues had better regard for the sabbatical research, students viewed better teaching, and colleagues around campus observed better campus citizenship". A key to making the sabbatical effective, Miller and Bai (2001) noted, was that the department chair must take a more active role in working with the faculty member on sabbatical to align expectations of the faculty member and the department, prepare for the departure and re-entry of the faculty member, and promote and demonstrate the success of the faculty member's sabbatical [29].

The department chair and academic dean indeed have important roles in helping to defend the sabbatical as a prerogative of the contemporary faculty member, but must also examine existing sabbatical leave outcomes as evidence that the leaves are worthwhile. The current study was designed to examine in more detail the earlier finding by [29]. that student's view better teaching by a faculty member upon return from a sabbatical. Although student evaluations of teaching effectiveness are far from perfect measures of instructional quality, they are the most commonly used criteria today for measuring good teaching, and as such, were determined to be acceptable as the primary data source for this study.

While the purposes for sabbatical leaves may differ from one campus to another and from one individual faculty member to another, it appears that university administrators and faculty members agree that the leave period should have a clear purpose and should result in outcomes that are of long-range benefit to the university. Moreover, the sabbatical leave should be productive and important from the faculty member's own viewpoint.

III. Math

This research paper utilized the qualitative method. The data were collected by in-depth interviews and small group discussions.

IV. Units

Institutions of higher education in universities level. Sabbaticals in academia can be need for an incentive, when policies for sabbaticals were established in academics, they were meant to allow instructors "to have a change of scenery; to experience a different university or research institute; to learn new techniques, to develop collaborations or to write papers or a book".

Sabbatical leave policies in higher education vary in their implementation but often loosely follow the Biblical tradition of sabbaticals for the land by allowing up to one year of sabbatical time for every 6 years spent teaching. The sabbatical time is paid at a percentage of the faculty member's full salary which varies depending on whether a full year is taken or if the faculty member takes the option of only one semester.

The findings revealed that the benefits and the cost of Sabbatical leave are 1) the benefits of sabbaticals in higher education are three-fold. There is benefit to the faculty member, the institution and the student. For the faculty member, it serves to allow for rejuvenation, reflection, fresh perspectives, opportunity for development of new professional relationships, staying current in his or her discipline and ultimately enhancing teaching. For the institution, it offers increased faculty efficiency, versatility, productivity, strengthened programs, enhanced learning environments, higher morale, increased institutional loyalty, enhanced faculty recruitment and retention and enhanced overall academic climate and reputation. These benefits combine to offer the ultimate benefit to students by having knowledgeable, well-prepared, motivated faculty in their classrooms.

As to the benefits of extended leave, traceable improvements to employee performance and improvements to the bottom line for companies are difficult to measure. Attaching metrics to rejuvenation, rest, time to think, job satisfaction, and improved likelihood that employees are more committed to the organization are noted as benefits of sabbatical leave programs, yet no studies exist that have tracked these subjective variables. While vacation time and family medical leave time are considered benefits that attract and retain employees, benefits are often more subjective and have few tethered expectations.

2) the cost of a sabbatical is borne both by the faculty and the institution. The faculty member must provide his or her own funding for the activities he or she engages in during the sabbatical. This can be accomplished through use of personal funds, grants, fellowships, loans and so on. The cost to the institution includes covering or canceling classes and paying for benefits, and continuing to pay the faculty member's salary during the absence. Since many sabbatical leave policies only allow the faculty member to collect a percentage of his or her salary, the resulting salary savings can be used to recover some of these costs. When a sabbatical is being supported with the full-salary for the faculty member the institution administration must make a decision to set aside funds to cover these expenses.

V. Helpful Hints

Higher education should promote sabbatical leaves as a recognized facet of professional development that is valuable to students, faculty members, the institution, and the surrounding community. There should be a strong connection between sabbatical programs and the wider professional development goals of the universities. And should do everything they can to establish, nurture, and preserve wide-ranging, effective sabbatical leave programs. This involves a thoughtful examination of process before, during and after the

sabbatical to encourage a large and diverse pool of applicants and approved projects. And it involves financial arrangements that provide sufficient compensation for faculty to actually accept the sabbatical awards. Sabbatical applications

And reports should be evaluated by a predominantly faculty committee. The process for evaluating both proposals and completed sabbatical reports should be objective and transparent. There should be an effective dissemination /replication process for sabbatical results, to achieve widespread use and awareness in the broader universities community.

VI. Recommendation for Future Research

In the future, research should continue to examine the role and benefits of sabbatical leaves. However, in order to ensure that sabbatical policies continue to be offered by postsecondary institutions, the academic community must now examine and report the relationship between the sabbatical leave and the benefits that accrue to the community and society. In addition, academe must find effective means of communicating these benefits to legislators and other stakeholders who may influence the sabbatical policies of the future.

VII. Conclusion

The literature supports the idea that the use of sabbatical leaves in higher education can be of benefit to both the institution granting it and the person receiving it. For higher education the purpose tends toward research needs; and the other is usually to allow the faculty member to update /maintain the technical skills they are teaching in the classroom.

The research regarding the sabbatical leave reveals that in general faculty members benefit from and are satisfied with their sabbatical leave experiences. These studies provide some insight about the ways in which the sabbatical leave facilitates faculty development and productivity. The findings also reveal the benefits of sabbatical leave that accrue to the home institution—increased productivity, improved programs, strengthened intellectual climate, and enhanced academic reputation.

Sabbatical leaves can provide a vibrant ongoing source of professional development and renewal that benefits all aspects of an institution. Institutions of higher education in universities level should do everything they can to establish, nurture, and preserve wide-ranging, effective sabbatical leave programs.

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Bussines valuation using financial analysis techniques

Luminița HORHOTĂ

***Abstract*—**Accounting information, market information, and basic aggregated economic data are the basic inputs needed for financial analysis and planning; statistical methods, regression analysis, operation research programming techniques, and computer programming knowledge are important tools for achieving financial planning and forecasting. In performing financial analysis and planning, it is important to know how to use the appropriate tools in analyzing the relevant data. The main purposes of this paper are: to show methods are used in cost–volume–profit (CVP) analysis and to demonstrate how modern econometric methods can be used to analyze the dynamic adjustment process of financial ratios and obtain new insights into the use of financial ratios in the financial analysis, planning, and forecasting

***Keywords*—** accounting, financial analysis, financial statements.

I. Financial Statements – Technical Rewiew

CORPORATE annual and quarterly reports generally contain four basic financial statements: balance sheet, income statement, statement of retained earnings, and statement of changes in financial position.

A. Balance Sheet

The balance sheet describes a firm's financial position at one specific point in time. It is a static representation, as if a snapshot had been taken, of the firm's financial composition of assets and liabilities at one point in time. The balance sheet is broken down into two basic areas of classification — total assets (debit) and total liabilities and shareholders' equity (credit). On the debit side, accounts are divided into six groups: intangible assets, property, plant and equipment, current assets, marketable securities — non-current, deferred taxes on income, and other assets. Current assets represent those accounts that are of a short-term nature such as cash and cash equivalent, marketable securities and accounts receivable, inventories, deferred tax on income and prepaid expense. Property encompasses all fixed or capital assets such as real estate, plant and equipment, and special tools. The balance sheet is useful because it depicts the firm's financing and investment policies. The use of comparative balance sheets, those that present several years' data, can be used to detect trends and possible future problems. The balance sheet, however, is static and therefore should be analyzed with caution in financial analysis and planning.

B. Statement of Earnings (Income Statement)

The usual income-statement periods are annual, quarterly, and monthly. Both the annual and quarterly reports are used for external as well as internal reporting. The monthly statement is used primarily for internal purposes such as the estimation of sales and profit targets, judgment of controls on expenses, The income statement is more dynamic than the balance sheet because it reflects changes for the period. It provides an analyst with an overview of a firm's operations and profitability of the firm on a gross, and operating, and a net income basis. Incomes includes sales, interest income, and other net income/expenses. Costs and expenses include the cost of goods sold; selling, marketing, and administrative expenses; and depreciation, depletion, and amortization. The difference between the income and cost and expenses results in the company's Net Earnings. A comparative income statement is very useful in financial analysis and planning because it allows insight into the firm's operations, profitability, and financing decisions over time.

C. Statement of Equity

Equity statements presents the changes of the shareowners equity items in the balance sheet. Retained earnings is the most important item in the statement of equity. These are the earnings that a firm retains for reinvestment rather than paying them out to shareholders in the form of dividends. The equity statement is easily understood if it is viewed as a bridge between the balance sheet and the income statement. The equity statement presents a summary of those categories that have an impact on the level of retained earnings: the net earnings and the dividends declared for preferred and common stock. It also represents a summary of the firm's dividend policy and shows how net income is allocated to dividends and reinvestment.

D. Statement of Cash Flows

Another extremely important part of the annual and quarterly report is the statement of cash flows. This statement is very helpful in evaluating a firm's use of its funds and in determining how these funds were raised. These statements of cash flow are composed of three sections:

- cash flows from operating activities
- cash flows from investing activities, and
- cash flows from financing.

The statement of cash flows, whether developed on a cash or working capital basis, summarizes long-term transaction

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that affect the firm's cash position. This statement reveals some important aspects of the firm's investment, financing, and dividend policies, making it an important tool for financial planning and analysis.

The cash flow statement shows how the net increase or decrease in cash has been reflected in the changing composition of current assets and current liabilities. It highlights changes in short-term financial policies. The statement of cash flow can be used to help resolve differences between finance and accounting theory. There is value for the analyst in viewing the statement of cash flow over time, especially in detecting trends that could lead to technical or legal bankruptcy in the future. Collectively, these four statements present a fairly clear picture of the firm's historical and current position.

E. Annual vs Quarterly Financial Data

Both annual and quarterly financial data are important to financial analysts; which one is more important depends on the time horizon of the analysis. Depending upon the patterns of fluctuation in the historical data, either annual or quarterly data could prove more useful. As Gentry and Lee (1983) discuss, understanding the implications of using quarterly data vs annual data is important for proper financial analysis and planning.

- Quarterly data has three components: trend-cycle, seasonal, and irregular or random components. It contains important information about seasonal fluctuations that "reflects an intra-year pattern of variation which is repeated constantly or in evolving fashion from year to year."
- Quarterly data have the disadvantage of having a large irregular, or random, component that introduces noise into analysis.
- Annual data is composed of two components, rather than the three of quarterly data, the trend-cycle, and the irregular component, but no seasonal component. The irregular component is much smaller in annual data than in quarterly data.

While it may seem that annual data would be most useful for long-term financial planning and analysis, seasonal data reveal important permanent patterns that underlie the short-term series in financial analysis and planning. In other words, quarterly data can be used for intermediate-term financial planning to improve financial management. Use of either quarterly or annual data has a consistent impact on the mean-square error of regression forecasting, which is composed of variance and bias. Changing from annual to quarterly data will generally reduce variance while increasing bias. Any difference in regression results, because of the use of different data, must be analyzed in light of the historical patterns of fluctuation in the original time-series data.

II. Static-Ratio Analysis and Its Extension

In order to make use of financial statements, an analyst needs some form of measure for analysis. Frequently, ratios are used to relate one piece of financial data to another. The ratio puts the two pieces of data on an equivalent base, which increases the usefulness of the data. For example, net income as an absolute number is meaningless to compare across firms of different sizes. If one creates a net profitability ratio (NI/Sales), however, comparisons are made easier. Analysis of a series of ratios will give us a clear picture of a firm's financial condition and performance.

Analysis of ratios can take one of two forms:

- First, the analyst can compare the ratios of one firm with those of similar firms or with industry averages at a specific point in time. This is one type of cross-sectional analysis technique that may indicate the relative financial condition and performance of a firm. One must be careful, however, to analyze the ratios while keeping in mind the inherent differences between firms' production functions and operations. Also, the analyst should avoid using "rules of thumb" across industries because the composition of industries and individual firms varies considerably. Furthermore, inconsistency in a firm's accounting procedures can cause accounting data to show substantial differences between firms, which can hinder comparability through the use of ratios. This variation in accounting procedures can also lead to problems in determining the "target ratio".
- The second method of ratio comparison involves the comparison of a present ratio with that same firm's past and expected ratios. This form of time-series analysis will indicate whether the firm's financial condition has improved or deteriorated. Both types of ratio analyses can take one of the two following forms: static determination and analysis, or dynamic adjustment and its analysis.

A. Static Determination of Financial Ratios

The static determination of financial ratios involves the calculation and analysis of ratios over a number of periods for one company, or the analysis of differences in ratios among individual firms in one industry. An analyst must be careful of extreme values in either direction because of the interrelationships between ratios. For instance, a very high liquidity ratio is costly to maintain, causing profitability ratios to be lower than they need to be. Furthermore, ratios must be interpreted in relation to the raw data from which they are calculated, particularly for ratios that sum accounts in order to arrive at the necessary data for the calculation. Even though this analysis must be performed with extreme caution, it can yield important conclusions in the analysis for a particular company.

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1) Liquidity Ratios

Liquidity ratios are calculated from the information on the balance sheet; they measure the relative strength of a firm's financial position. Crudely interpreted, these are coverage ratios that indicate the firm's ability to meet short-term obligations. The current ratio is the most popular of the liquidity ratios because it is easy to calculate and it has intuitive appeal. It is also the most broadly defined liquidity ratio, as it does not take into account the differences in relative liquidity among the individual components of current assets. A more specifically defined liquidity ratio is the quick or acid-test ratio which excludes the least liquid portion of current assets, inventories.

2) Leverage Ratios

If an analyst wishes to measure the extent of a firm's debt financing, a leverage ratio is the appropriate tool to use. This group of ratios reflects the financial risk posture of the firm. The two sources of data from which these ratios can be calculated are the balance sheet and the income statement. The balance-sheet leverage ratio measures the proportion of debt incorporated into the capital structure.

3) Activity Ratios

This group of ratios measures how efficiently the firm is utilizing its assets. With activity ratios one must be particularly careful about the interpretation of extreme results in either direction; very high values may indicate possible problems in the long term, and very low values may indicate a current problem of not generating enough sales or of not taking a loss for assets that are obsolete. The reason that high activity may not be good in the long term is that the firm may not be able to adjust to an even higher level of activity and therefore may miss out on a market opportunity. Better analysis and planning can help a firm get around this problem. The days-in-accounts-receivable or average collection-period ratio indicates the firm's effectiveness in collecting its credit sales. The other activity ratios measure the firm's efficiency in generating sales with its current level of assets, appropriately termed turnover ratios. While there are many number of turnover ratios that can be calculated, there are three basic ones: inventory turnover, fixed assets turnover, and total assets turnover. Each of these ratios measures a quite different aspect of the firm's efficiency in managing its assets.

4) Profitability Ratios

This group of ratios indicates the profitability of the firm's operations. It is important to note here that these measures are based on past performance. Profitability ratios generally are the most volatile, because many of the variables affecting them are beyond the firm's control. There are three groups of profitability ratios:

- those measuring margins
- those measuring returns
- those measuring the relationship of market values to book or accounting values.

Profit-margin ratios show the percentage of sales dollars that the firm was able to convert into profits. There are many such ratios that can be calculated to yield insightful results, namely, profit margin, return on asset, and return on equity. Return ratios are generally calculated as a return on assets or equity. The return on assets ratio measures the profitability of the firm's asset utilization. The return on equity indicates the rate of return earned on the book value of owner's equity.

Market-value analyses include:

- marketvalue/book-value ratio and
- price per share/earnings per share (P/E) ratio.

Overall, all five different types of ratios have different characteristics stemming from the firm itself and the industry as a whole. For example, the collection-period ratio is clearly the function of the billings, payment, and collection policies of the pharmaceutical industry. In addition, the fixed-asset turnover ratios for those firms are different. This might imply that different firms have different capacity utilization.

5) Estimation of the Target of a Ratio

An issue that must be addressed at this point is determination of an appropriate proxy for the target of a ratio. For an analyst, this can be an insurmountable problem if the firm is extremely diversified, and if it does not have one or two major product lines in industries where industry averages are available. One possible solution is to determine the relative industry share of each division or major product line, then apply these percentages to the related industry averages, and then derive one target ratio for the firm as a whole with which its ratio can be compared. One must be very careful in any such analysis because the proxy may be extremely over- or underestimated. The analyst can also use SIC codes to properly define the industry of diversified firms. He can then use three- or four-digit codes and compute his own weighted industry average. Often an industry average is used as a proxy for the target ratio. This can lead to another problem, the appropriate calculation of an industry average, even though the industry and companies are fairly well defined. The issue here is the appropriate weighting scheme for combining the individual company ratios in order to arrive at one industry average. Individual ratios can be weighted according to equal weights, asset weights, or sales weights. The analyst must determine the extent to which firm size, as measured by asset base or market share, affects the relative level of a firm's ratios and the tendency for other firms in the industry to adjust toward the target level of this ratio. One way this can be done is by calculating the coefficients of variation for a number of ratios under each of the weighting schemes and to compare them to see which scheme most consistently has the lowest coefficient variation.This would appear to be the most appropriate weighting scheme. Of course, one could also use a different weighting scheme for each ratio, but this would be very tedious if many ratios were to be analyzed. Note that the median, rather than the average or mean, can be used, to avoid needless complications with respect to extreme values that might distort the computation of averages. In the dynamic analysis that follows, the equal-weighted average is used throughout.

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B. Dynamic Analysis of Financial Ratios

In basic finance and accounting courses, industry norms are generally used to determine whether the magnitude of a firm's financial ratios is acceptable. Taken separately, ratios are mere numbers. This can lead to some problems in making comparisons among and drawing conclusions from them. In addition, by making only static, one-ratio-to-another comparisons, we are not taking advantage of all the information they can provide. A more dynamic analysis can improve our ability to compare companies with one another and to forecast future ratios. Regressing current ratios against past ratios helps one analyze the dynamic nature and the adjustment process of a firm's financial ratio.

III. Cost-Volume-Profit Analysis and Its Applications

Cost–volume–profit (CVP) analysis is a synthesized analysis of the income statement. Volume, price per unit, variable cost per unit, and the total fixed cost are the key variables for doing this kind of analysis. The basic type of CVP analysis is the break-even analysis, which can be extended to operating and financial leverage analysis. All of these analyses are important tools of financial analysis and control.

Technically, ratio-variable inputs are required for performing these analyses. Conceptually, CVP and its derived relationships are designed to analyze the income statement in terms of an aggregated ratio indicator. Hence, CVP analysis can be regarded as one kind of financial ratio analysis.

A. Deterministic Analysis

Deterministic break-even analysis is an important concept in basic microeconomics, accounting, finance, and marketing. Mathematically, the operating profit (EBIT) can be defined as:

$$EBIT = q(p - v) - F, \quad (1)$$

where:
EBIT = earnings before interest and tax
q = quantity of goods sold;
p = price per unit sold;
v = variable cost per unit sold;
F = Total amount of fixed costs; and
p − v = contribution margin.

If operating profit is equal to zero, implies that:

$$q(p - v) - F = 0 \quad (2)$$

or that:

$$q(p - v) = F, \text{ that is,}$$

$$q = \frac{F}{(p - v)} \quad (3)$$

Equation (3) represents the break-even quantity, or that quantity of sales at which fixed costs are just covered. There are two kinds of breakeven analysis, linear and nonlinear. There are very important economic interpretations of these alternative break-even analyses:
- linear representation of the total revenue curve implies that the firm operates within a perfect output or product market;
- the linear total cost curve implies that the input market is linear or perfect and the return (economies) to scale is constant. If these conditions do not hold, linear break-even analysis becomes either unrealistic or only an approximation of the real situation facing the firm. In the real world, returns (economies) to scale can either be constant, increasing, or decreasing. A nonlinear representation of the variable cost and total revenue curves is a more accurate representation of the real one break-even level of sales using this form of analysis.

Break-even analysis can be used in three separate but related ways in financial management, that is:
- to analyze a program of modernization and automation
- to study the effects of a general expansion in the level of operations, and
- in new-product decision.

These operating leverage decisions can be defined more precisely in terms of the way a given change in volume affects profits. of its profit.

B. Stochastic Analysis

In reality, net profit is a random variable because the quantity used in the analysis should be the quantity sold, which is unknown and random, rather than the quantity produced, which is internally determined. This is the simplest form of stochastic CVP analysis, for there is only one stochastic variable and one need not be concerned about independence among the variables. A slightly more complicated form of stochastic CVP analysis is obtained when it is assumed that both the quantity of goods sold (q) and the contribution margin (p−v) are stochastic variables and are independently distributed. The independence assumption is reasonable because the second stochastic variable is defined as the contribution margin, rather than the three separate random variables q, p, and v . In this situation, quantity and price are probably not independent, because both distributions are determined by imperfections in the product market. Under the contribution margin approach, one variable that is subtracted from prices, variable costs, has a distribution that is determined by imperfections in the input market. This drastically reduces the degree of correlation with the quantity sold. Besides the applications discussed in this paper, both CVP and breakeven analysis can be integrated with the net present value (NPV) method of capital budgeting decisions to do financial analysis. The major difference between the NPV type of break analysis and the "naive" break-even analysis does not take account of the cost of capital;

IV. Conclusions

The usefulness of accounting information in financial analysis is conceptually and analytically evaluated. Both statistical methods and regression analysis techniques are used to show how accounting information can be used to perform active financial analysis for the companies.

In these analyses, static ratio analysis is generalized to dynamic ratio analysis. The necessity of using simultaneous-equation technique in conducting dynamic financial ratio analysis is also demonstrated. In addition, both deterministic

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and stochastic CVP analyses are examined. The potential applications of CVP analysis in financial analysis and planning are discussed in some detail.

Overall, this paper gives a good understanding of basic accounting information and methods, which are needed for financial analysis and planning.

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Challenges of strategic rethinking of development of travel intermediaries in Croatia in terms of dynamic environment

Iris Mihajlovic

***Abstract*-**This paper highlights the importance of strategic management in the business of travel intermediaries, based on a critical evaluation of potential and possibilities in order to adapt the business operations, according the dynamic changes in the environment. The firstpart of the paperemphasizes the necessityof directingresourcestowardactivitieswhich can ensurebetterstrategicposition. Strategic thinking in tourism is primarily related to the acceptance of the meaning of longer time frame for the implementation of long-term goals that guarantee a successful business, the active relation to environment through the cyclic relationship between tension andbalance and abilities to make decisions based on the methods, concepts, models shaping the development strategy that should be implemented. In the second part of the paper the empirical research has been conducted using the method of SWOT analysis,on a sample of 200 travel agencies in Croatia. Results of the survey on a sample of travel agencies show that managers recognize the importance of the vision as an guiding idea of business specialization, ICT and the market recognizability based on brand that makes strengths for marketing positioning of intermediaries. That are preconditions for successful operations of travel intermediaries in the future. Avoiding the threats and remedying of deficiencies in the business in accordance to requirements of demand and pointing out of an innovative approach in terms of motivation and education of employees, represent the important activities that should be implemented through development strategies of intermediaries.

Key words- SWOT analysis, vision, travel intermediaries, dinamic environment

I. INTRODUCTION

Oneof the focalarguments speaks in favor offuturesuccess of the business of travelintermediariesin the tourism marketrefers to thenecessityof understandingof key trendsanduse ofthe associatedpositive effectswith the simultaneousattemptto avoidthe negative effects. Strategic rethinkingin tourismthereforeprimarily refers todirecting of potentialstowardactivities thatcan provide betterstrategic position, acceptingthe meanings of longertime framethat is importantforbusiness success, the complianceof activerelation to environmentand the ability to make decisionson the basis ofmethods, concepts, modelswhichshape and implementdevelopment strategy.

II. LITERATURE REVIEW: TOWARDS CHALLENGES AND BUSINESS OPPORTUNITIES OF TRAVEL AGENCIES

The distinction of travel agencies is a result of the logical consequences of developing conditions in the market. This is directly related to the position of travel agencies, their characteristics and functions that are based on dominant business areas and the specific contents of activities performed by agencies. The limitations have been taken into the account in the accordance with scopes of activities, types of ownership, organizational structures, modes of integrations in the market, and the predominance of elements that are integrated in business of travel agencies. SWOTanalysisis the part of thestrategic analysis. This qualitativemethod, throughthe assessment offactorsanddimensions oftheenvironment(strengths, weaknesses, opportunities, threats) aims to showcertain phenomenaorsituations[1]. It is basedon the identification ofstrengths and weaknessesin the internalenvironment of company, constitutedbyfactorsof organizational structure, organizational cultureandorganizational resources. Furthermore analysis relieson theidentification ofopportunities and threats, focusing on theimpactsandconsequencesof dimensionsinthe externalenvironment, creating some opportunities, butoften limitationsforbusiness development and growth within enterprises. These includetechnologicaldimensions, cultural dimensions, also dimension of economic, natural and social environments. Dynamics ofchanges in the environmentinfluences theactivities of enterprisesadaptedto the environment changes, through the activities of selectionof acceptablecombinations ofpotentials and the implementation of reasonablestrategy.

While creatingtheir offersand thecontents, travelintermediariesneed to applystrategic analysisinformulating a strategyfor business decision makingrelated tothe activities, applying theSWOT matrix[2].This facilitates detailed analysis and the understanding of its own strengths and weaknesses, also opportunities and threats from the environment [3], and the creation of tailored package deals according preferences of travelers based on the capabilities in areas in which they operate.Overcomingits own weaknesses andthreatsfrom the environment, using own advantages, the analysis enabledthe adaptation of contentsof activitiestowards preferences of travelers[4].As an incentive fornew actionsaimed towardshigherlevels ofdevelopmentand safe market positions, it is necessary tocreate a balancethroughhigh-qualityandcompetitive products. The foresight is the visualisation or anticipation of all components affecting an enterprise in the future, aiding an harmonious realization of set objects. It act as an impetus and represents the first firm step in the process of contemporary strategic management in an enterprise. It is a qualitative category, on which should be based critical and analytical approach to the environment, upon realistic fundamentals, otherwise the process of strategic management would only be a routine technique. Vision as an leading idea should be implemented in activities of strategic leadership of enterprises[5].

The most intensiveverification of the flexibility ofbusiness areasandfunctionsfor the purpose ofmore efficient operationsis occurring quitein tourism, especiallywith regard tointermediariesandtheir functions, ie.

travel agenciesthat aredirectly influenced bytechnological innovations, as well aschallengesthat create new opportunitiesandperspectives.Monitoring oftrends, innovativeenterprises in tourism make an effort to redirecttheir resourcesandskillstomeet the requirementsof tourists, ensuring the added valuerealizedbytransactions [6]. The development of information-communication technologies(ICT), results in higherefficiency.It will lead tothe reorganizationof communication strategiesandthe ways of doing businessof suppliersand stakeholders in the destination[7].Innovative technologiesimprove the efficiency ofsuppliers, promote interoperability, personalizationandpermanentnetworking ofparticipants in the process. The most important advantagesof new technologiesrepresentthe accessibility of information, andincreased efficiencywhichreduces costsof the production. The knowledgeis produced, sharedandaccessiblewith minimal costs. The power of knowledgecannot be alienatedfrom globalcomprehension. Buyersandsellerscan shareinformation, specifications, production processesbeyond national boundaries. ICTprovidesaccess to multiplemarketsand theincreased access toglobalsupply chains. At the same timeuse ofICThas led toincreased transparencywhichenables lowerprices. Considering theway oforganization oftravel due to stronginfluenceof ICT, there was an evidenttrend oflessusingof services of travel agenciesontourist markets[9].It affects new tendencies in choosing of travel trips, new motifs which are the precursors for the development of innovative products aiding to the transformation of business in travel intermediaries[9].The Internet becomes increasingly commonand themore dominantsource of information, traveldistribution channel. It has becomeespecially popularamong the youngerpopulation[10]. Alternative distribution channels:travel agencyorInternet? It should not bea doubtwith regardabout capabilities of integration of previoustwo separate channelsin one. The role of social media is very important in the area of market research and the promotion. Intermediaries should recognize the performances of that media. It would be alsopossible to offerfranchisees to travel agencieswith regard toappearances on Internet, oftendue tolack of knowledgein the field ofdevelopmentof suchmarketing activities[11].The transformation ofdistribution channels, the creation of innovativeproducts, as well as flexibilityin the way of product placement are logicalconsequencesof the organizationalDarwinism: according to whichthesurvival ofbusinesses is linked tothe abilityof continuous monitoringof changes, and the development ofenterprises is associated withthedegree of flexibilityof its organizational structure.Therefore,travel agenciesmustto find ways tosuccessfullycontinuebusiness operations, usingadvantages ofICT, excluding the possibilityof substitutionof itsmediating role, butaccepting thecomplementarities ofICT.Thisis confirmedthrough thesimplified procedure in bookingand the acquiring of products and services, andlower costsof product placement in travel agencies[12]. One of the waysto survive in thetourist market, keeping a competitive position refers to the activities of specializationanddifferentiation [13][14][15].Travel agenciesneed to bespecialized inactivitiesAccording to market segments, travel agencies should customaze contents of activities of travel packages. Personalization ofservicesisoneof the main challenges faced bytravel agencies. So, through thedifferentiationandinnovative tools, tour operators are increasinglytargetedonthe level ofpersonalized servicesandan increasingflexibility.Usingdynamic packages (DP) travelerschooseservicesindependently, integratingthem intotheir ownpackages. Usinginnovative tools, most visiblechangesarein the way ofplacement of products, also the modeof communication, and performance of services thattravelers (throughthe technique ofpurchase) perceive ashigher quality[16].

The authors define DP as: new integrated system that has adopted the performance of www., by implementing a capitalization value of Internet. Stakeholders and consumers are free in selection of services that are provided (eg flight and other service providers) and they are involved in combinations considering creation of their own personalized *tailor-made trave*l [17], an offer that is consisted from two or more components of travel that could be combinated [18], industry of electronic word that enables totourists to create tailor-made itineraries , merging the multiplicative optional components in realization of transactions in real time [19].

Dynamic packages (DP) enable comprehensiveinsurance package pricing, “bundle” of services(with hidden individual prices of components) and the transaction within a time frame 5 to 15 seconds, whereby the customer can access the database from multiple separate control systems[20].The prominent innovative tool represents new technology for distribution of trips. Operators must have technological support with capabilities that can provide and enable DP to customers . In the future it is expected a large increase of the use of DP. Important elements of definition of DP are: the combination of two or more services, wide range of services for customers, instant creation of offer in time unit, dynamic pricing per unit in time, online connectivity. DP are characterized by: thespecifics of: the model of buying of components; suppliers of various components are commercially related;simultaneity of the purchase; wide possibility of creating and connecting; online travel agencies enable buying of services from different sources in that way of composing their own package.At the same time it is possible to offer highly specialized touristproducts that can be characterized as highly specific packages. In terms of content, services are acceptable to tourists who belong to geographically dispersed market segments that are tailored to their requirements with regard to possible combinations. Those are competitive among other innovative solutions and applications that can be offered.Travel agenciesmusttake into account thenew market trends, to stimulateinnovationsin product placement, booking, and alsoincontentsof products. The development oftravel agenciesin the future primarilydepends onthe organizational structure, organizational cultureandresourcesin the enterprise. Smart actions concerning the allocation of resources, learning and experiences, due to strategic orientation are key in adapting to market trends and possibilities of product customization.

III. METHODOLOGY OF RESEARCH

Preliminaryresearchhas beenconductedinCroatia inorderto studythelevelofcustomizationof activitiesof travel

agenciesin Croatiaandto definethe guidelinesfor their development. This raises thehypothesis: Dynamic changesinenvironmentrequire theadaptationof activitiesof travel agenciesin Croatia, aimed atdiversificationandinnovationof theirtourist products. i.e packages.

The survey encompasses travel agencies according to the following: region (Continental Croatia, Istria and Primorje, Dalmatia); dominant business functions (organizational, intermediary) ; business type (initiative, receptive, initiative- – receptive), business activity (wholesale, retail); organizational structure (without or with a branch network), and area of business (international or national) . Selection frameworkcontains a list of target population members, and it is usually in the form of lists and databases. Sampled travel agencies were selected from the Croatia company directory of the Croatian Chamber of Economy, available on the website http://www1.biznet.hr/HgkWeb/do/extlogon.
The number of 1350 business entities whose primary activity is intermediation in tourism (NACE 79 Travel agency, tour operator and other reservation services and related activities), made basic statisticalsample. Random sample is drawn from defined selection framework. By means of random number generator 200 travel agencies were selected, companies were contacted by phone so as to verify their primary activity, and willingness to participate in the survey (2011). With regard todifferent features of travel agencies participating in the survey, it can be concluded that their selection was representative. Results from the survey sample can be considered adequate for making relevant conclusions. In order to assess the dynamics of changes that determine the terms of business of travel agencies, in the conducted survey research - respondents are managers of travel agencies in Croatia. They are asked to evaluate the development of prospects of travel agencies.

IV. SURVEY FINDINGS

The state of resources defined as potential strengths has been assewas evaluated: brand and market identity, original vision as an presumption of business specialization, the favorablemacro and microlocationand the awarenesstomoderninformation and communication technologies(Fig. 1). Weaknessesareanalyzedthrough: the absence from the international tourist market, unskilled human resources[1], lack of competitiveness of prices, and unadapted program /products [2] , thatis most often associatedtopackage holidays. Asinternal strengthsmore than three fourthsof respondents statedbrand and market identity (79%), andoriginalvision (77%), and the share of(72%) respondents stateda favorablemacro and microlocation andthe awarenesstoICT (71%).

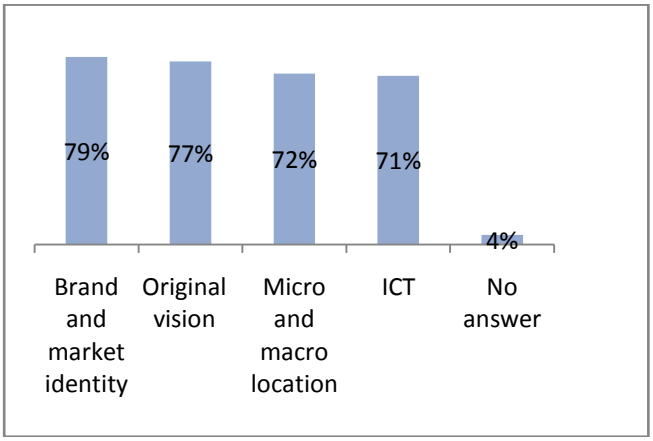

Fig.1The share ofrespondentsconsidering theattitudesaboutthe internalstrengthsin an internalenvironmentof travel agencies
Source: Opinion poll conducted on the sample of the travel agencies in the Croatia,; field analyses by the author

According to the characteristicsof travel agencieswithregard to theinternalstrengths,mangers most frequentlystatedthe significance of the acquiredmarket recognition, (significantlymore thanthan the average of travel agencieswholesalers stated – (100%), and agencies with a branch network (90%)). The originalvisionas a prerequisite forspecialization, significantly more thanthe average of travel agencies statedthe same group ofagencies, but alsothose with initiative- – receptive business type (93%). Agencies are driven the necessityof monitoringmarket trendsandadaptingof standardizedproducts of agenciesto new needs. Lessshare of respondents statedinternalweaknesses, so(40%) of respondents stated the absence from the international tourist market, (24%) of respondents stated unskilled human resources , (24%) of respondents statedthe lack of competitivenessof prices, and (16%) of respondents pointed out not adaptedprogram/products.

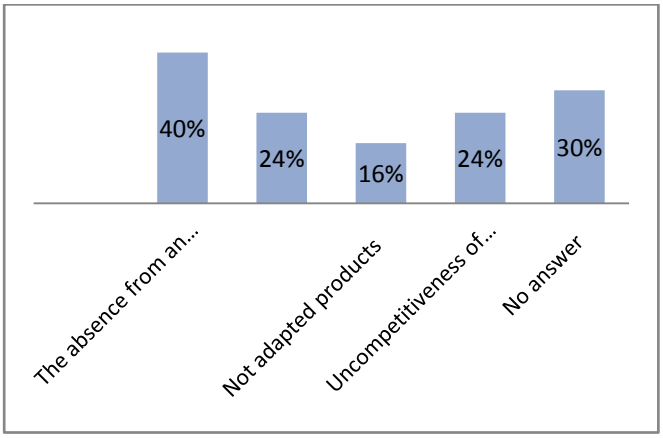

Fig. 2 The share ofrespondentsconsidering theattitudesaboutthe internalweaknesses in an internalenvironmentof travel agencies
Source: Opinion poll conducted on the sample of the travel agencies in the Croatia,; field analyses by the author

According to characteristicstravel agencieswith regard to theinternalweaknesses, the absence offromworldtourism marketisthe most

[1] The authorindicates theimportanceof encouragingthe educationandtrainingin acquiringof specializedskills, related toknowledge of: at leasttwoforeign languages, cultural and historical heritage, the economic categoriesandtheir relations.
[2]Usually, it is about packages

frequentlyhighlighted, particularly among the agenciesfromContinentalCroatia(50%), andself-criticism is furtherreflectedintravel agencieswith dominantintermediary business functions(44%). However, this lackalsostands outtravel agencieswithout network branches(48%). Lack of competitiveness of prices, to a greater extentthan the average is the problemforagencies of receptive business type (26%). Not adaptedprogram/productto a greater extentthan the average,statedagencies from Dalmatia(23%), receptivecharacterof agencies(29%).

Respondents were asked toassesswhichof the followingexternal opportunitiesrepresentthose significant totheir agency: customization of agencies toward specificmarket segments, the abilityto expand into newtourist markets, theinsufficientquality of productsof other intermediaries(Fig.3).

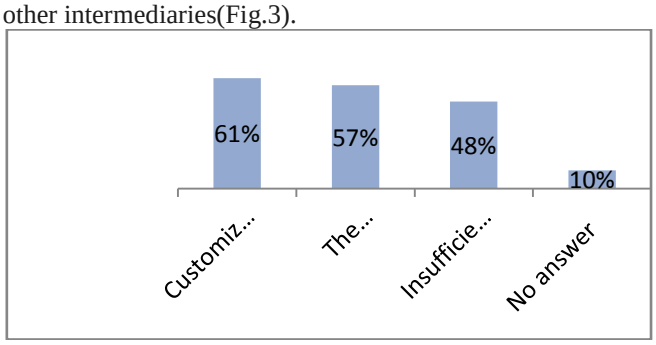

Figure 3 The share ofrespondentsconsidering theattitudesaboutthe external opportunities in the environment

Source: Opinion poll conducted on the sample of the travel agencies in the Croatia,; field analyses by the author

Respondentsto a greater extentstress the significance ofexternal threats, as well asrestrictivefactorsof the environment, so(82%) of respondentspointed out business in terms of crisis and turbulent conditions, (66%) of respondents stated inappropriate macroeconomic policy, andthe share of (59%) respondents emphasizes uncompetitiveness of prices on the market. Table 3 shows the share of respondents considering external threats.

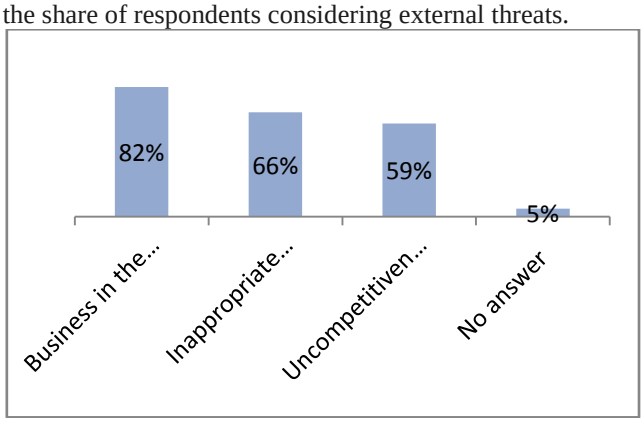

Figure 3 The share of respodents with regard to threats in external environment of travel agencies

Source: Opinion poll conducted on the sample of the travel agencies in the Croatia,; field analyses by the author

Considering thecharacteristics oftravel agencieswith regard to theexternal opportunities, customization of agencies toward specificmarket segments is usually emphasized, so above the averageof the samplestand outinitiative – receptive travel agencies (76%), agencieswith a branch network (75%), and the lowest share of (42%) belongs to receptivetravel agencies. Possibilitiesto expand into newtourist marketsis noticedmorethan average amongagencies in Continental Croatia(66%), while the same attitudes share respondents from wholesalers (100%), andagencies that operate on international market (82). The smallestshare oftravel agencies (9%) with regard to thepossibilityof expansioninto new marketsis observedin the regionof Istria and Primorje. Travel agencieswhich operateon the international marketwith share of (32%) stand outa lack ofquality of the productsof otherintermediaries as achance.

With regard to thecharacteristics oftravel agencies according to their statements, the consequences ofexternalthreats are more than an average experienced in Dalmatia, and retailers. , uncompetitiveness of prices on the market. and the lack of competitiveness ofprices on the market(40%). The shareof wholesalers highlightthe problem of inadequatemacroeconomic policyis(100%). Comparingtravel agenciesaccordingthe above characteristics, the largestshare oftravel agencies(68%) that operate on international market point out consequences of the lack of competitiveness ofprices on the market.

The uncompetitiveness of prices as an externalthreat stand out(40%) of initiative agencies. Based on attitudes presented as results, whicharepreviously elaborated in detail, it is possible toform aSWOT analysisintabularform(Tab.1). It can be concludedthatrespondentshighly evaluatetheir strengthsandunderestimate theirweaknesses. At the same timeunderestimate theopportunitiesand overestimatethreats which they are exposed. In this area, as in otherareasof travel agencies, the need forproactive approachisclear. Table 1 shows SWOT analysis oftravel agenciesbased on theopinionsof managersof travel agenciesin Croatia

Table1 SWOT analysis oftravel agenciesbased on attitudes of managersof travel agenciesin Croatia

SWOT analysis of travel agencies in Croatia	
Strengths of travel agencies	**The weaknesses of travel agencies**
Brand and market identity (79%) Original vision the prerequisite of specialization (77%) Micro and macro location (72%) ICT (71%)	The absence from an international tourist market (40%) Unskilled hunžman resources (24%) Uncompetitiveness of prices (24%) Not adapted products tourist products (16%)
Oportunities of travel agaencies	**Threats of travel agencies**
Customize of agencies toward market specific segments (61%) The ability to expand into new tourist markets (57%) Insufficient quality of products of other intermediaries (48%)	Business in the crisis (82%) Inappropriate macroeconomic policy (66%) Uncompetitiveness of prices on the market (59%)

Source: Opinion poll conducted on the sample of the travel agencies in the Croatia, September 2010; field analyses by the authors

Source: Opinion poll conducted on the sample of the travel agencies in the Croatia, September 2010; field analyses by the authors

In relation to the attitudes of managersconsidering possibilities of specialization of business with empasis on the organization of functions and the main areas of activities within travel agenices, (57%) of respodents pointed out that possibilities of business specialization should be focused through the need for creation of new forms of travel packages. The share of (43%) respodents answered that possibilities of business specialization should be focused through the feature of innovative forms of placement of individual services (Table. 2).

Table 2.Attitudes of managers considering the possibilities of business specialization of travel agencies

Attitudes of managers considering the possibilities of business specialization of travel agencies	Frequency	Percent %
Through the need for creation of new forms of travel packages	47	57
Through the features of innovative forms of placement of individual services	35	57
Total	82	100

Source: Opinion poll conducted on the sample of the travel agencies in the Croatia, September 2010; field analyses by the authors

These are very interesting data with emphasis on necessity of implementing different approaches to the concept, moving away from the stereotype - standardized forms of product placement. Since the changes of business oftravel agencies has been mostly felt in the area of the placement of products i.e. packages, the implementation of the strategy of innovation repesents animportant step in meeting new trends in consumers behavior, including new criteria for market access, evaluating the quality of services and products.

Table 3 Areas to be felt the most intensive impact of new market trends on activities of travel agencies

Areas to be felt the mostintensive impacts of new market trends through the activities of travel agencies	Frequency	Percent %
Human Resources Management	**36**	**44**
Technology of organization of travel packages	**46**	**56**
Total	**82**	**100**

Source: Opinion poll conducted on the sample of the travel agencies in Croatia, September 2010; field analyses by the authors.

In responses relating to the most intensive impacts of new market trends in activities within business area of travel agencies, share of (46%) repodents pointed out the area of creation of travel packages influenced by new technology (using innovative tools) , and the labor intensity area (36%) (through compentences of employees, skills, education and experiences).

The shown results support thesis considering the importance of coplementarities of values of both resources: technologies and human resources, crucial for possibillities of future direction of business activities toward shaping innovative products according dinamic market changes. Prominentresults of the research confirm thehypothesisH1, according to which *changes in the environmentrequirecustomizationof activitiesof tourist agencies in Croatia, focused on diversificationand theinnovationof theirtourist products*, with an emphasis onthe continuityof monitoringmany factorswhoseeffectsrequirethe flexibility to adaptbusiness policies..

V. ON GUIDELINESFOR DEVELOPMENT OFTRAVEL AGENCIESIN CROATIA

The development ofspecific tourismproducts is based onthe identity of thedestination. With theactive approachanddirectingresources,(defined asassumptions), accordingsteadybusiness opportunities, using thestrategically targetedpoliciesat national level, through the creationof competitiveandrecognizabletourism productsof microdestinations, the regional development needs to be encouraged. With theassumptionof easierandsafer use ofthe availablefacilities, the recognizable tourist productshave to be built.

Strategicrethinkingneeds to gotowards thechoosingof rationalstrategy(the concentration of capitalin a wayof integrationanddiversification), which guaranteesproduct placementandprofitable business, assuming acontinuity ofthe developmenton the basis ofresource conservation, encouragingquality of facilitiesfor achievingthe continuousattractiveness of areasbasedonthe sustainable development.. In this context,question arisesthe position oftravel agencies incontemporary conditions. Pursuant tostrategic analysisto identify theopportunities and constraintsfrom the environment, travel agencies, in connivancewith changesandmarket trends, need torely its business activitiesuponavoidance ofthreatsfrom theexternalenvironment, usingopportunitiescontained intechnological, social, andeconomic changes. Activitiesmust be directedon overcoming theweaknesses, using forcestowardsinnovation ofbusiness, reorganizationorsometimesan unavoidablere-engineeringbusiness, target-oriented on areas thatwill guarantee the success.To be able in further adaptation according to specific market segments in existing and new markets, for agencies mean taking advantages of specialization and innovation that are increasingly being used regarding the creation of products and distribution methods. The new role of travel agencies will be particularly

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evident through the expansion into new markets, using strategies of diversification and innovation strategies.

Agencies shoulduse itscomparative advantages ofquality, whichwouldbemanifested in more comprehensiverichness ofservices under the program of packages. Regardless ofcharacter ofbusiness,in this wayagenciesachievea more competitivepositionin relation to otherentities thatoffer similarsubstitutiveproducts. At the same timeagencieswillhave to becompetitive and more activein order toavoidexternalthreatsand to be ableto use them in their ownbusiness benefits (e.g.the placementof simpler productsbypromotional pricing), Threatsare obviousin terms of business, inmarket conditionsdefined bycrisis periods, out of whicharisetherequests for additionallowering of prices. Threatsarealso seen in thetermsof: inadequateprogramof macroeconomicpolicy whichfurtherdiscouragesbusinessentities,andlack of competitivenessof productsderived fromstandardizedpackages.

In accordance to the trend of development of tourist products, according to the specific interests of tourists, it is increased the loyalty of travelers in relation to special features package tours. Keeping up with the trends on tourist market, the emphasis is on branding of products which is obvious in business activities of wholesaler, tour operators). As the assumption of specialization, at the level of of travel agencies, the development of original vision is proposed. This is in accordance with the highlighted necessity of using of diversification strategy in the future.Travel agenciesshould encourage theuse ofICT, conducting permanenteducation of its employees. That would influence the efficieny andcompetitiveness of travel agencies. Travel agenciesshould alsomake an effort on an assesment towards globaltourism market, which willhighlight theuse of the benefitsof globalizationtrends. However, thiswill not bepossiblewithoutadditional educationof employeesin order to increasethe valueof human capital, whichis prerequisite fordevelopment of enterprisesin the future. „Area of price competitiveness“ and „adjusting the program / products towards needs of tourists“ will represent categories that will continue playing an important role among the actors in the market.Activities in travel agencies will be developed depending on the opportunities and changes in the environment. In this context, the importance of intensifying of relations between tourist demand and supply will be emphasized, regardless characteristics of objects of exchange (of products), that contain higher or lower level of specifics. So, in the future we can expect further course of evolution and development of travel agencies based on the intensification of changes in following directions: improving the quality of information, responses of market niche, specializing of activities, product diversification, and the use of innovation in the system of distribution.

The author declare that there is no conflict of interests regarding the publication of this paper

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Methodological approach to the synthesis of rational variants of actions for reconstruction of compact built-up development areas.

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***Abstract* —** The paper describes the necessity of complex reconstruction of compact built-up development areas in urban and rural settlements in order to create a more comfortable environment for the life activity of the population, improve the living conditions, and also accelerate socio-economic development of the country.

For the design of complex reconstruction of compact built-up development areas it is reasonable to apply the methods of system analysis. At that, these areas are presented in the form of a system model as a system complex city-planning formation.

To establish and implement effective variants of actions for reconstruction of these areas, a system approach is proposed, which is based on the multistage decision-making method.

The set of methods of decision-making on the choice of rational actions, described in the paper, provides the opportunity of reconstruction of compact built-up development areas to the required level of comfort at the acceptable consumption of resources.

Keywords - Compact built-up development areas, system complex city-planning formation, reconstruction, variants of states and actions, technical comfort, resource intensity.

I. INTRODUCTION

Formation of an effective approach to providing comfortable and affordable housing for various segments of population, with modern social, ecological, engineering, and transport infrastructure is an extremely topical issue that requires a scientific, system solution.

Such an approach presupposes [1]: 1) the development and implementation of innovative city-planning and architectural projects (new cities, residential areas, quarters and complexes, rural settlements, residential and public buildings, constructions), taking into account social, environmental and economic requirements; 2) the development of modern high-speed rail and road transport; 3) establishment of engineering infrastructure to meet the requirements of energy efficiency, resource-saving, and low-waste; 4) formation of the living environment harmonious with nature in urban and rural settlements.

The lack of real opportunities for a part of population, both in large and small cities to realize their need for comfortable living conditions prevent the full and harmonious development of the personality. Besides, the demographic activity of the population may decrease, and the social tension in the society may raise, which leads to a slower social and economic development of the country.

Increasing the quality of life, and in particular the improvement of living conditions should become the economic policy of the government in socially responsible countries.

Compact built-up development areas (CBDA), which are the life activity environment for different groups of the population, as a rule, only partly meet the modern requirements of a comfortable living because of the inevitable physical and moral depreciation of objects that are a part of these territories [2,3,4].

A compact built-up development area is understood as a part of the city area, which is designed to organize the comfortable and safe living environment and life activity of the population, including residential and public buildings of various types and urban constructions, engineering-and-network and engineering-and-transport infrastructure, and other objects of social, cultural and consumer services.

The complex reconstruction of CBDA allows not only to extend the life cycle of buildings, constructions and other objects, but also to significantly improve their quality, equip them with modern engineering equipment, increase their energy efficiency, operational reliability and durability, and improve the architectural expression of the buildings.

An effective solution to the problem of the complex renovation of CBDA helps to reduce social tension and improve the socio-economic condition of the country.

With that, the implementation of such complex programs requires the use of budgetary resources at different levels (federal, regional and municipal), as well as private investment (own or borrowed funds of the citizens).

Put in this way, the problem of implementing an effective reconstruction of CBDA at the acceptable level of financial and material-and-technical resources in the conditions of the modern market economy requires the search and implementation of the new, adequate to the present situation, theoretical and methodological approaches.

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II. PROBLEM FORMULATION

For the development of theoretical and methodological approaches to solving this problem, we apply the methods of system analysis which mean representing modern living environment and life activity of the population, i.e. CBDA, as a system complex city-planning formation (CPF) [2, 4,6,7].

The system complex city-planning formation is a set of the interconnected and controllable spatial, architectural and engineering solutions of the living environment of population groups (society), providing the certain favorable conditions for habitation and human life activity due to existing historical, economical and material-and- technical potential of the given territory.

The subject structure of the CPF is given in the articles [2 - 4] with characteristics of its components, general and specific objects and is shown in Fig. 1.

In accordance with established techniques [3-5], it is appropriate to take technical comfort (TC) and resource intensity (P) as the main efficiency indicators of functioning and reconstruction of CPF.

In general, the formulation of the problem of forming the action variants and solutions implementing them on the reconstruction of objects of architectural and construction component of CPF is shown in Fig. 2.

This paper discusses the methodological approach to the synthesis of action variants on the functional stratum in accordance with Fig. 2.

III. PROBLEM SOLUTION

First of all, it is necessary to select CPF intended for primary reconstruction. Selection procedure is as follows.

Selected are the CPF, the condition of which is evaluated by the efficiency indicator of TC as "bad" or "very bad" by the relevant methods [3, 4, 5].

Figure 3 shows an example of selecting the CPF with low TC indicator - "bad".

Then the specialists - experts determine the required score of the CPF by TC after the reconstruction - which is "good" or "excellent" - and design the required state by TC of all components, general objects and specific objects (SO) for the determined TC of the CPF.

This is most simply realized by appointing of the desired state by TC of all components and general objects, which is the same as required by TC of CPF, i.e. - "good" or "excellent."

Obviously, in accordance with the hierarchical subject structure of CPF - Fig. 1, the achievement of the TC of all general objects of the score "good" or "excellent" will provide the achievement of an appropriate score by all CPF components, which, in turn, will form a proper score of the CPF itself.

It should be noted that with respect to SO, which the general objects and components consist of, such an approach would be irrational. There can be a lot of specific objects, and each of them can have their importance, certain specificity; and so "mechanical", averaged bringing them to a state with the defined indicator of TC that matches the required indicator of TC of the CPF can lead to extremely high resource intensity of the reconstruction resulting in high financial costs.

It seems reasonable to suggest some required variants of the state by TC for the considered SO, providing the required state of general objects by TC - "good" or "excellent" - an example in Table 1.

Table 1. Possible variants of the SO states by TC, providing the transfer of common objects from the TC state of "satisfactory" to the desired state of "good."

SO state by TC	**The numbers of SO and evaluation of their state by TC**				
	1	2	3	▪▪▪	n
Initial, real	B	S	G	S	VB
Required 1st variant	G	G	G	G	G
2nd variant	G	S	G	EX	S
3rd variant	S	G	EX	S	G

where the TC indicators of SO take the values: ex - "excellent"; g - "good"; s - "satisfactory"; b - "bad"; vb - "very bad".

The calculations showing how by reducing the physical depreciation (P) and moral depreciation (M) of general objects and SO their required state of TC is reached, are produced by the methods described in [3, 4].

On the functional stratum, realizing the subprocess of "generation of variants", for each variant of the required state of SO, the variants of possible actions on the reconstruction and modernization of these SO are formed.

The list of main action variants:

- extraordinary repair (ER);
- capital repair (CR); reconstruction (RC);
- demolition and dismantling of the object (DD);
- demolition and dismantling of the old object accompanied by the construction of the new one (DDN);
- extraordinary repair of the old SO accompanied by the construction of the new additional SO (ERN);
- capital repair of the old SO accompanied by the construction of the new additional objects (CRO);
- reconstruction of the old SO accompanied by the construction of the new additional objects (RCN).

As the limitations, we note the following points:

1. With respect to each SO only one of the listed actions is applicable.

2. Actions for the reconstruction of specific objects SO are formed and selected separately for each variant of required states of specific objects SO.

The decision on the applicability of any specific action on the reconstruction of the given SO to the state with required value of TC indicator is made based on the initial values of its indicators - physical depreciation, moral depreciation, TC, working drawings of this SO in the initial state and the damage report prepared at the stage of examining the SO.

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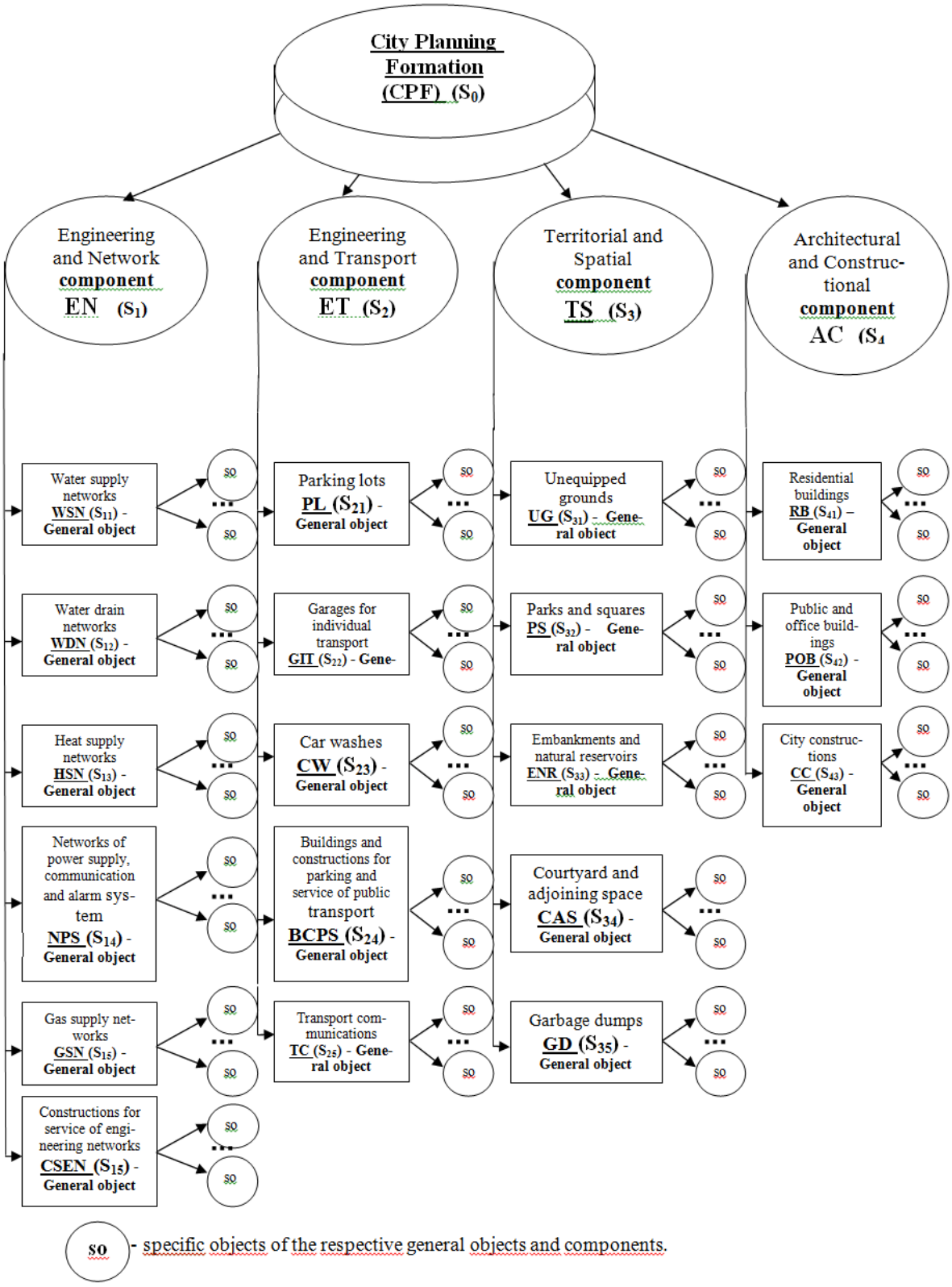

Fig.1 The subject structure of the city-planning formation as a system including its components and objects

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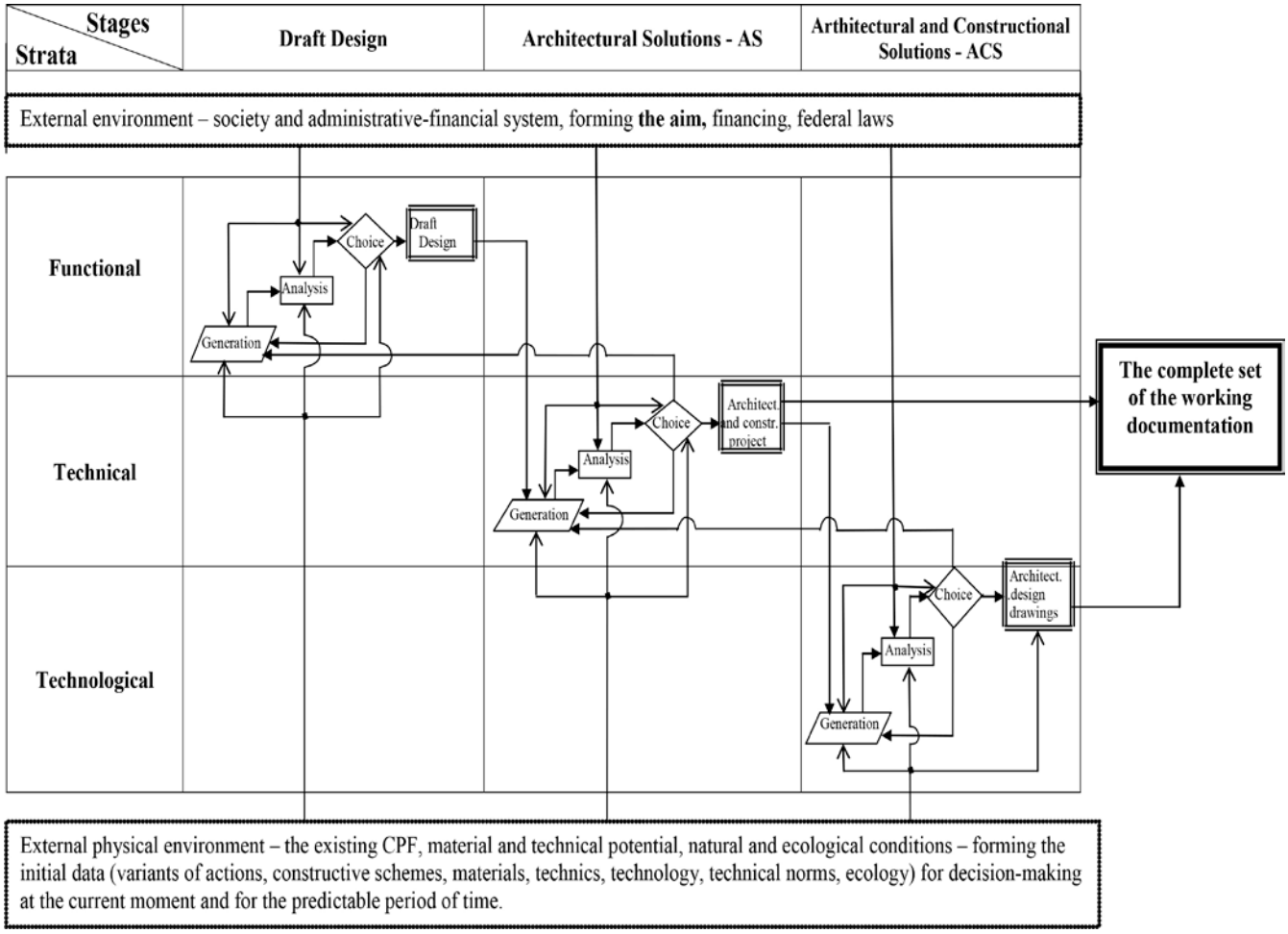

Fig 2. Technological scheme of decision-making on reorganization of compact built-up development areas

At that, there may be more than one separate decisions made on the choice of a certain action.

To implement the subprocesses such as "analysis of variants" - "choice of variants", for each variant of the required states of SO and, respectively, for each variant of actions, the specialists develop the sketch flowcharts (SFC) of SO.

An example of possible SFC for some variant of the required states of SO and related actions leading the SO to the required state, is shown in Table 2, where the lines are all possible actions, and the columns are SO with the score lower than the required.

The sketch flowchart of SO, concerning which the use of any of these actions is possible, should contain the necessary graphic and text documents with the most common characteristics.

The composition of the SFC of SO with application to it of the listed actions is provided in the Table 3, where the "plus" means the need for this document, and "minus" - the absence of need. Then the developers of the reconstruction project themselves, based on the SFC, forecast and set the values of the indicators of moral depreciation and physical depreciation of the considered SO, which it will gain after the reconstruction.

Then, the "folding" of these indicators - P and M is performed by the known method [3, 4] with the definition of the indicator of TC state of the SO. This establishes the compliance of the obtained TC values of the given SO with the required value of the state indicator by TC of this SO (RQTC).

If the received TC of the SO is worse than the RQTC of the SO, then this action is not considered. Here, on the basis of the developed SFC, determine $R = \varphi\{P(S_1),M(S_1)\}$ – the resource intensity of implementation of each admissible solution S1 to the actions for the considered SO, listed in Table 2, and record it in Table 4.

The evaluation of R in terms of value is made depending on the selected action by applying the following documents and techniques: the predictive value of the action by the object-analogue from the database of design and construction organizations; evaluation by specialists-experts etc.

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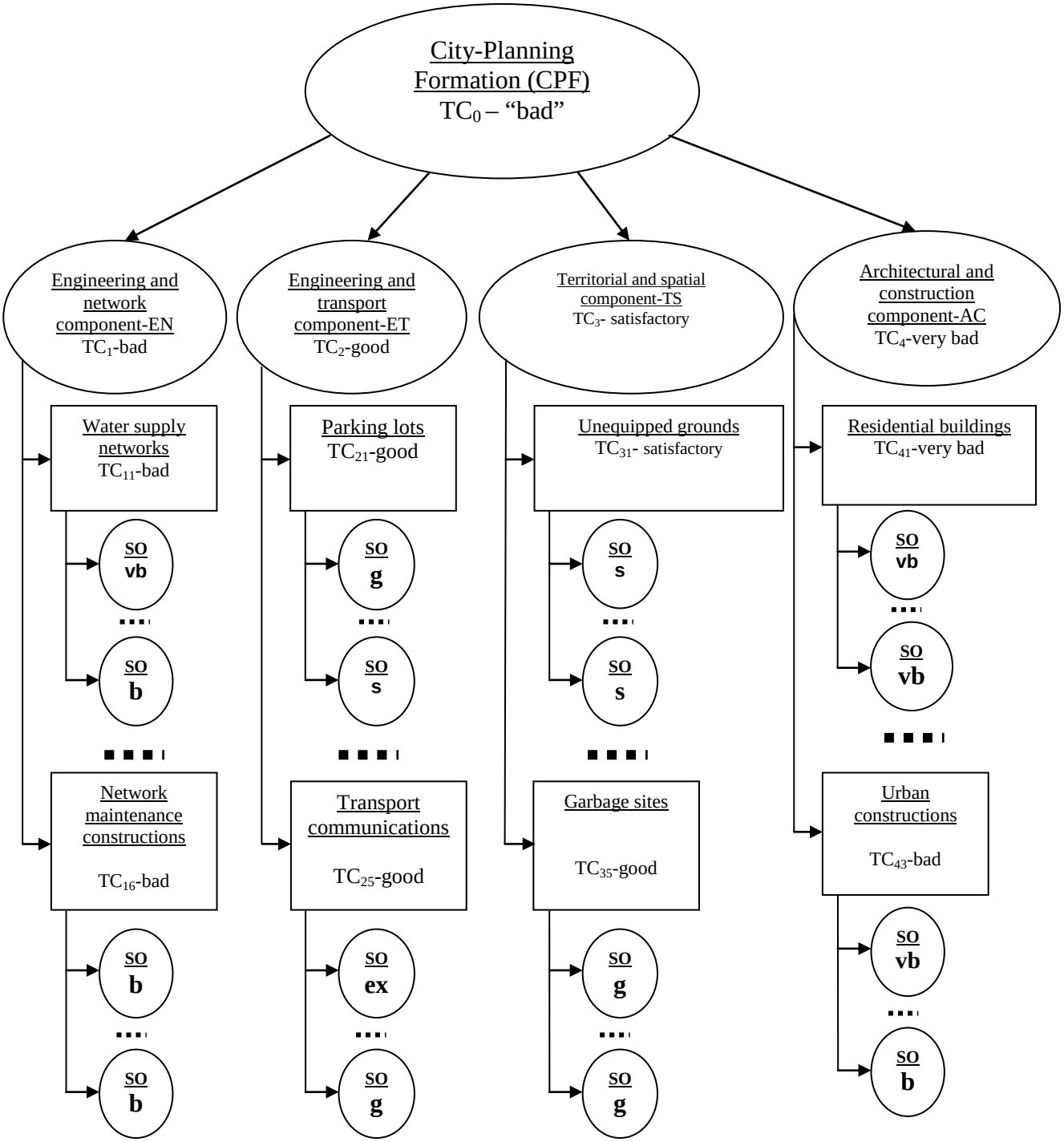

TC0 - the indicator of technical comfort of the CPF;
TC1 - TC4 - the indicators of technical comfort of the CPF components;
TC11 - TC16; TC21 - TC25; TC31 - TC35; TC41 - TC43 - the indicators of technical comfort of the general objects of CPF;
SO - specific objects; the indicators of TC of the specific objects take the following values: EX - excellent; G - good; S - satisfactory; B - bad; VB - very bad.

Fig. 3. An example of the CPF TC indicator "tree".

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Table 2. Possible values of SFC for some variant of required states of SO and appropriate actions bringing SO into this state

Numbers of SO / Actions		1	2	3	4	5
	RQTC	G	G	G	G	G
	RTC	S	VB	G	S	B
1. Extraordinary repair (ER)		SFC_{11}	0	0	0	0
2. Capital repair (CR)		SFC_{21}	0	0	$SFC_{24.}$	SFC_{25}
3. Reconstruction (RC)		SFC_{31}	SFC_{32}	0	SFC_{34}	SFC_{35}
4. Demolition and dismantling of the object (DD)		0	SFC_{42}	0	0	0
5. Extraordinary repair of the old SO with the construction of the new additional SO (ERN)		SFC_{51}	0	0	0	0
6. Capital repair of the old SO with the construction of the new additional SO (CRN)		0	0	0	SFC_{64}	SFC_{65}
7. Reconstruction of the old SO with the construction of the new additional SO (RCN)		0	SFC_{72}	0	0	SFC_{75}
8. Demolition and dismantling of the old SO with the construction of the new additional SO (DDN)		0	SFC_{82}	0	0	SFC_{85}
N O T E. **RQTC** – the required TC of the SO, **RTC** – the real TC of the SO.						

Table 3. The composition of the SFC for different actions on the reconstruction of SO.

Actions / Composition of SFC	ER	CR	RC	DD	ERN	CRN	RCN	DDN
1. The general plan of the area with the "connection" of the SO location and indication of its size.	+	+	+	+	+	+	+	+
2. Detailed drawings of the SO before implementing the specific action with highlighting of the sites having significant P and M.	+	+	+	+	+	+	+	+
3. The list and methods of repair work.	+	+	+	-	+	+	+	-
4. The choice and general description of the SO reconstruction method with specification, if necessary, of its new size.	-	-	+	-	-	-	+	-
5. The choice and general description of the method of demolition or dismantling of the old object.	-	-	-	+	-	-	-	+
6. The general overall scheme of the future SO, with the connection of location, with the brief description of space-planning solutions, constructions, systems and elements.	-	-	+	-	+	+	+	+

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Table 4. Distribution of the resource intensity R by possible action variants on the functional stratum for the reconstruction of SO.

Actions \ Numbers of SO		1	2	3	4	5
	RQTC	G	G	G	G	G
	RTC	S	VB	G	S	B
1. Extraordinary repair (ER)		R_{11}	0	0	0	0
2. Capital repair (CR)		R_{21}	0	0	$R_{24.}$	R_{25}
3. Reconstruction (RC)		R_{31}	R_{32}	0	R_{34}	R_{35}
4. Demolition and dismantling of the object (DD)		0	R_{42}	0	0	0
5. Extraordinary repair of the old SO with the construction of the new additional SO (ERN)		R_{51}	0	0	0	0
6. Capital repair of the old SO with the construction of the new additional SO (CRN)		0	0	0	R_{64}	R_{65}
7. Reconstruction of the old SO with the construction of the new additional SO (RCN)		0	R_{72}	0	0	R_{75}
8. Demolition and dismantling of the old SO with the construction of the new additional SO (DDN)		0	R_{82}	0	0	R_{85}
N O T E. **RQTC** – the required TC of the SO, **RTC** – the real TC of the SO.						

As a part of the accepted limitations, the problem of synthesis of the solutions to actions on the functional stratum is to generate possible solution variants by forming the data tables such as 2, 4.

An expedient action variant is chosen by analyzing the data in Table 4 and selecting such solutions that minimize the total resource intensity.

IV Conclusion

The methodical approach to the choice of variants of the condition of compact built-up development areas, considered as system complex city-planning formations (CPF), and its constituent parts – components, general and specific objects (SO), is proposed

The methodical approach to the choice of the reasonable variant of solutions on the actions for reconstruction of both SO of the CPF and the CPF itself by the choice of such solutions on the actions which minimize their total resource intensity, is developed.

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The contribution of the averaged regression quantiles for testing max-domains of attractions

Jan Picek, Martin Schindler

***Abstract*—The contribution deals with testing of the Gumbel domain of attraction against Frechet or Weibull domains. We propose tests based on weighted averaged regression in the linear regression model. Jureckova and Picek (2014) showed asymptotic equivalence to the $alpha$-quantile of the location model. The weighted averaged quantiles can be seen as a possible generalization of the quantile idea. Following Drees (1998) we consider a class of smooth functionals of the tail quantile function as a tool for the construction of tests in the linear regression context. The used methods will be illustrated on simulated data.**

***Index Terms*—extreme value index, max-domain of attraction, quantile regression, statistical tail functional.**

I. Introduction

IF we are interested in such events as the extreme intensity of the wind, high flood levels of the rivers or extreme values of environmental indicators, or maximal or minimal performance of foreign exchange rates or share prices, we should focus on the tails of the underlying probability distribution rather than in its central part. Many authors have dealt with an estimation of the tails of the distribution. However, besides the point and interval estimation, a typical and important part of statistical inference and modelling is the testing of hypotheses.

Let $V_1, V_2, ..., V_n$ be independent and identically distributed random variables with common distribution function F with unknown shape, location and scale parameters, belonging to some max-domain of attraction. F is in the domain of attraction of an extreme-value distribution G_γ if for some index $\gamma \in \mathbb{R}$ ($F \in \mathcal{D}(G_\gamma)$):

$$\exists_{b_n \in \mathbb{R}}^{a_n > 0} : F^n(a_n x + b_n) \underset{n\to\infty}{\longrightarrow} G_\gamma(x)$$

for all x, with

$$G_\gamma(x) := \begin{cases} \exp(-(1+\gamma x)^{-1/\gamma}), & 1+\gamma x > 0 \quad \text{if } \gamma \neq 0 \\ \exp(-\exp(-x)), & x \in \mathbb{R} \qquad\quad \text{if } \gamma = 0 \end{cases}$$

the Generalized Extreme Value (GEV(γ)) distribution in the von Mises parameterization. Gnedenko (1943) has established that the class $\{G_\gamma\}_{\gamma\in\mathbb{R}}$ represents in an unified version all possible non-degenerate weak limits of the maximum $V_{n:n}$, up to location/scale parameters. GEV(γ) d.f. reduces to Weibull, Gumbel and Fréchet distributions, respectively, for $\gamma < 0$, $\gamma = 0$ and $\gamma > 0$.

For positive γ, the behavior in the tail of the underlying distribution function F has important implications since it may suggest, for instance, the presence of infinite moments. All distribution functions belonging to $\mathcal{D}(G_\gamma)$ with $\gamma < 0$ are light tailed with finite right endpoint. The intermediate case $\gamma = 0$ is of particular interest in many applied fields where extremes are important, because an inference within the Gumbel domain G_0 is simple and also the great variety of distributions has an exponential tail.

Taking all into consideration, it has become clear that it is advantageous to look for the most appropriate type of tail before fitting empirical distributions at high quantiles. Effectively, separating statistical inference procedures according to the most suitable domain of attraction for the underlying d.f. F has become an usual practice.

A test for Gumbel domain against Fréchet or Weibull max-domain has received the general designation of statistical choice of extreme domains of attraction (see e.g. Castillo et al. (1989), Hasofer and Wang (1992), Fraga Alves and Gomes (1996), Marohn (1998), Segers and Teugels (2001) and Neves, Picek and Alves (2006)).

One of the interesting ideas of the recent advances in the field of statistical modeling of extreme events has been the development of models with time-dependent parameters or more generally models incorporating covariates. Consider the linear regression model

$$\mathbf{Y}_n = \mathbf{X}_n\boldsymbol{\beta} + \mathbf{E}_n, \tag{1}$$

where $\mathbf{Y}_n = \mathbf{Y} = (Y_1, \ldots, Y_n)'$ is a vector of observations, $\mathbf{X}_n = \mathbf{X}$ is an $(n \times p)$ known design matrix with the rows $\mathbf{x}_i = (x_{i1}, \ldots, x_{ip})'$, $i = 1, \ldots n$, $\boldsymbol{\beta} = (\beta_1, \ldots, \beta_p)'$ is the $(p \times 1)$ unknown parameter $(p > 1)$ and $\mathbf{E}_n = \mathbf{E} = (E_1, \ldots, E_n)'$ is an $(n \times 1)$ vector of i. i. d. errors with a distribution function $F \in \mathcal{D}(G_\gamma)$. We assume that the first column of $\mathbf{X}_n$ is $\mathbf{1}_n = (1, \ldots, 1)'$, i.e. the first component of $\boldsymbol{\beta}$ is an intercept.

The present paper deals with the two-sided problem of testing Gumbel domain against Fréchet or Weibull domains in the model (1), i.e.,

$$F \in \mathcal{D}(G_0) \quad \text{versus} \quad F \in \mathcal{D}(G_\gamma)_{\gamma\neq 0}. \tag{2}$$

II. Averaged regression quantiles

Koenker and Basset (1978) introduced the regression quantile as a generalization of usual quantiles to linear regression model. The key idea in generalizing the quantiles is the fact that we can expressed the problem of finding the sample quantile as the solution to a simple optimization problem.

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This leads, naturally, to more general method of estimating of conditional quantiles fuctions.

They defined the α-regression quantile $\hat{\boldsymbol{\beta}}(\alpha) = (\hat{\boldsymbol{\beta}}_1(\alpha), \ldots, \hat{\boldsymbol{\beta}}_p(\alpha))'$ $(0 < \alpha < 1)$ for the model (1) as any solution of the minimization

$$\sum_{i=1}^{n} \rho_\alpha(Y_i - \mathbf{x}_i'\mathbf{t}) := \min, \quad \mathbf{t} \in \mathbb{R}^p, \tag{3}$$

where

$$\rho_\alpha(x) = x\psi_\alpha(x),\ x \in \mathbb{R}^1 \text{ and } \psi_\alpha(x) = \alpha - I_{[x<0]},\ x \in \mathbb{R}^1. \tag{4}$$

The same authors characterized the α-regression quantile $\hat{\boldsymbol{\beta}}(\alpha)$ as the component $\boldsymbol{\beta}$ of the optimal solution $(\boldsymbol{\beta}, \mathbf{r}^+, \mathbf{r}^-)$ of the linear program

$$\begin{aligned} \alpha\mathbf{1}_n'\mathbf{r}^+ + (1-\alpha)\mathbf{1}_n'\mathbf{r}^- &:= \min \\ \mathbf{X}\boldsymbol{\beta} + \mathbf{r}^+ - \mathbf{r}^- &= \mathbf{Y} \\ \boldsymbol{\beta} \in \mathbb{R}^{p+1}, \mathbf{r}^+, \mathbf{r}^- &\in \mathbb{R}^n_+ \quad 0 < \alpha < 1, \end{aligned} \tag{5}$$

where $\mathbf{1}_n = (1, \ldots, 1)' \in \mathbb{R}^n$. This simplex approach may be used to computing regression quantiles. Implementation is contained for example in the software R.

One of the important properties of regression quantiles is their consistency, that is $\|\hat{\boldsymbol{\beta}}(\alpha) - \boldsymbol{\beta}(\alpha)\| = o_p(1)$, for each $\alpha \in (0,1)$ under some conditions of design matrix $\boldsymbol{X}$ and distribution function F, $\boldsymbol{\beta}(\alpha) = (\beta_1 + F^{-1}(\alpha), \beta_2, \ldots, \beta_p)$. For details, see Jurečková, Sen and Picek (2013).

Jurečková and Picek (2014) introduced the averaged regression quantile

$$\bar{B}_n(\alpha) = \bar{\mathbf{x}}_n^\top \widehat{\boldsymbol{\beta}}_n(\alpha), \qquad \bar{\mathbf{x}}_n = \frac{1}{n}\sum_{i=1}^{n} \mathbf{x}_{ni} \tag{6}$$

and studied its properties and relations to other statistics. Some properties of $\bar{B}_n(\alpha)$ are surprising: $\bar{B}_n(\alpha)$ is asymptotically equivalent to the $[n\alpha]$-quantile of the location model. We can prove it under the following regularity conditions on the distribution function F and the design matrix $\boldsymbol{X}$.

(F.1) F has a derivative f that is positive and bounded on some left neighbourhood of the right endpoint x^*; f' is bounded and f'' exists on some left neigbourhood of x^*.

(F.2) the von Mises condition holds, i.e.

$$\lim_{t \to x^*} \frac{(1-F(t))f'(t)}{f^2(t)} = -1 - \gamma.$$

Fix b such that $0 < \delta \le b - |\gamma| \le |\gamma| + \delta$, for some $\delta > 0$.

(X.1) $x_{i1} = 1$, i = 1, …, n.

(X.2) $\lim_{n\to\infty} \boldsymbol{D}_n = \boldsymbol{D}$, where $\boldsymbol{D}_n = n^{-1}\boldsymbol{X}_n'\boldsymbol{X}_n$ and $\boldsymbol{D}$ is a positive definite $(p \times p)$ matrix.

(X.3) $n^{-1}\sum_{i=1}^{n} \|\mathbf{x}_i\|^4 = O(1)$ as $n \to \infty$.

(X.4) $\max_{1\le i\le n} \|\mathbf{x}_i\| = O(n^{\Delta})$ as $n \to \infty$, where

$$\Delta = \frac{b - |\gamma| - \delta}{1 + 2b} < \frac{1}{4}$$

It has been shown in Dienstbier (2011) using similar results as in Jurečková (1999), that under condition (F.1)-(F.2) and (X.1)-(X.4)

$$\sup_{\alpha_n^* \le \alpha \le 1-\alpha_n^*} \left\| \sigma_\alpha^{-1}(\bar{\mathbf{x}}_n^\top \widehat{\boldsymbol{\beta}}_n(\alpha) - \bar{\mathbf{x}}_n^\top \boldsymbol{\beta}(\alpha)) \right\| = O_P(n^{-1/2}C_n), \tag{7}$$

where $C_n = C(\log\log n)^{1/2},\ 0 < C < \infty$ and

$$\begin{aligned} \alpha_n^* &:= n^{-\frac{1}{1+2b}} \\ \sigma_\alpha &:= \frac{(\alpha(1-\alpha))^{1/2}}{f(F^{-1}(\alpha))}, \qquad 0 < \alpha < 1. \end{aligned}$$

III. Tests based on averaged regression quantiles

Dienstbier (2011) used (7) and showed the similarily of the tail quantile process in i.i.d. case and the averaged regression quantiles process.

Theorem III.1. *Consider the linear model (1) and conditions (F.1) – (F.2), (X.1) – (X.4.). Suppose also that the F satisfies the second order extreme value condition*

$$\lim_{t\to\infty} \frac{\frac{U(tx)-U(t)}{a(t)} - \frac{x^\gamma - 1}{\gamma}}{A(t)} = \frac{1}{\rho}\left(\frac{x^{\gamma+\rho}-1}{\gamma+\rho} - \frac{x^\gamma - 1}{\gamma}\right) \tag{8}$$

with tail quantile function $U(t) := \inf\{x : (\frac{1}{1-F})(x) \ge t\}$ for all $x > 0$ with ρ the non-positive second order parameter, $a > 0$ and A a suitable positive or negative function. Then there exists a sequence of Wiener process $\{W_n(s)\}_{s>0}$ such that for each $\varepsilon > 0$

$$\begin{aligned} \sup_{1/k_n \le s \le 1} s^{\gamma+1/2+\varepsilon} \Bigg| \Bigg(& \frac{\bar{\mathbf{x}}_n^\top \widehat{\boldsymbol{\beta}}_n(1-\frac{k_n}{n}) - \bar{\mathbf{x}}_n^\top \boldsymbol{\beta}_n}{a(n/k_n)} \\ & - \frac{F^{-1}(1-k_n/n)}{a(n/k_n)} - \frac{s^{-\gamma}-1}{\gamma}\Bigg) - s^{-(\gamma+1)}W_n(s) \\ & + \sqrt{k}A(n/k_n)\Psi_{\gamma,\rho}(s^{-1}) \Bigg| \xrightarrow[n\to\infty]{\mathrm{P}} 0 \end{aligned}$$

where $(k_n)_{n\in\mathbb{N}}$ is an intermediate sequence such that $k_n > n^{\frac{2b}{2b+1}}$ and $k_n/n \to 0$ as $n \to \infty$ and $\Psi_{\gamma,\rho}$ is defined as in de Haan and Ferreira (2006).

See Dienstbier (2011).

Similarly as in Drees (1998), we can derive the asymptotic properties of the whole class of smooth and location and scale invariant functionals of the tail quantile function.
Suppose to have a sample of observations $Y_1, \ldots, Y_n$ obtained from the linear model (1). Define a subsample

$$Z_{k_n} := \bar{\mathbf{x}}_n^\top \widehat{\boldsymbol{\beta}}(\tau_{k_n}) - \bar{\mathbf{x}}_n^\top \boldsymbol{\beta}, \tag{9}$$

i.e. for some $\tau_{k_n} = (1 - k_n/n)$ and the intermediate order sequence of k_n such that $k_n/n \to 0$ as $n \to \infty$ and $k_n > n^{\frac{2b}{2b+1}}$. Define also the empirical tail quantile function of this subsample as

$$Q_n^Z(t) := Z_{n-[k_n t]:n}$$

for $t \in [0,1]$, Denote the empirical tail quantile function of the unobservable errors of the model (1) as

$$Q_n^E(t) := E_{n-[k_n t]:t}$$

for $t \in [0,1]$. Let T is a suitable functional, then it follows from Theorem III.1 and Theorem 2.1 in Drees (1998) that the distributions of $T(Q_n^E)$ and $T(Q_n^Z)$ coincide. If we introduce the concept of Hadamard differentiability according to Drees (1998) then we obtain the same solution as in the location model for the test statistics of the various tests for Gumbel domain. Hence we can generalize these tests in the situation of the regression model on the basis of averaged regression quantile in the following way.

First we create subsample

$$Z_i^* := \bar{\mathbf{x}}_n^\top \widehat{\boldsymbol{\beta}}(i/n)). \tag{10}$$

Then we plug averaged regression quantiles into the usual test statistics.

For example, the test statistic $T_{k,n}^*$ suggested by Neves, Picek and Alves (2006) has the form

$$T_{k,n}^* := \frac{V_{n:n} - V_{n-k:n}}{\frac{1}{k}\sum_{i=1}^{k}(V_{n-i+1:n} - V_{n-k:n})} - \log k \tag{11}$$

where $V_1, V_2, ..., V_n$ are i.i.d. random variables and $V_{1:n} \leq V_{2:n} \leq ... \leq V_{n:n}$ the order statistics after arranging the random sample in nondecreasing order, $k = k_n$ is a sequence of positive integers, $k_n \to \infty$ as $k_n/n \to 0$, as the sample size n tends to infinity.

We come back to the linear regression model (1)

$$\mathbf{Y}_n = \mathbf{X}_n\boldsymbol{\beta} + \mathbf{E}_n,$$

where the errors are from an underlying distribution function F with unknown shape, location and scale parameters, belonging to some max-domain of attraction $F \in \mathcal{D}(G_\gamma)$. If we are interested in the two-sided problem of testing Gumbel domain against Fréchet or Weibull domains

$$F \in \mathcal{D}(G_0) \quad \text{versus} \quad F \in \mathcal{D}(G_\gamma)_{\gamma \neq 0}.$$

then we suggest the following test statistics based on the largest regression quantiles

$$T_\tau^* := \frac{Z_n^* - Z_{n-l}^*}{\frac{1}{l}\sum_{i=1}^{l}\left(Z_{n-i+1}^* - Z_{n-l}^*\right)} - \log l \tag{12}$$

where $Z_i^* := \bar{\mathbf{x}}_n^\top \widehat{\boldsymbol{\beta}}(i/(n+1)), \quad i = 1, \ldots, n$, and the l "observations" exceed the high averaged regression threshold $\bar{\mathbf{x}}_n^\top \widehat{\boldsymbol{\beta}}(\tau_{k_n})$ for some $\tau = \tau_{k_n} = (1 - k_n/n)$, where k_n is the intermediate order sequence $k_n \to \infty$ as $k_n/n \to 0$, as the sample size n tends to infinity.

We can prove on the basis of a result in Neves, Picek and Alves (2006) that T_τ^* under the null hypothesis converges to a random variable with the Gumbel distribution and the test is consistent

Theorem III.2. *Suppose $F \in \mathcal{D}(G_0)$ and that second order property (8) holds for $\gamma = 0$. Let A is a suitable positive or negative function in (8) and let k_n be an intermediate sequence of integers such that $A(\frac{n}{k_n})\log^2 k \to 0$, as $n \to \infty$ ($\rho = 0$) or $A(\frac{n}{k_n})\log k \to 0$, as $n \to \infty$ (a negative ρ) and let $\tau = \tau_{k_n} = (1 - k_n/n)$,*

$$T_\tau^* \xrightarrow{d} G, \quad G \sim Gumbel$$

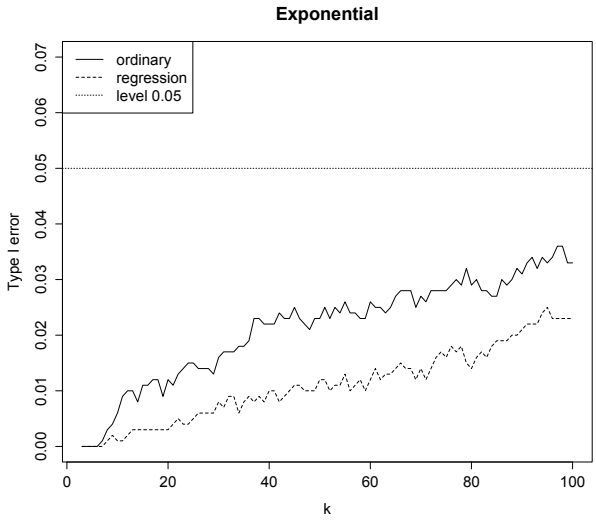

Fig. 1. Estimated type I error probability of T_τ^* and $T_{k,n}^*$ at a level $\alpha = 0.05$ for exponential distribution against $\tau = 1 - k/n$, $k = 3, \ldots, 100$.

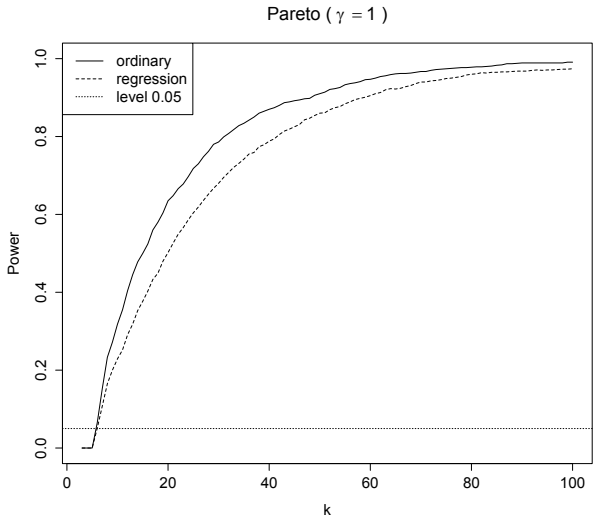

Fig. 2. Empirical power of T_τ^* and $T_{k,n}^*$ at a level $\alpha = 0.05$ for Pareto distribution ($\gamma = 1$) against $\tau = 1 - k/n$, $k = 3, \ldots, 100$.

Theorem III.3. *Suppose $F \in \mathcal{D}(G_\gamma)$ and that following condition holds for some $\gamma \in \mathbb{R}$.*

$$\lim_{t\to\infty} \frac{U(tx) - U(t)}{a(t)} = \frac{x^\gamma - 1}{\gamma}$$

for every $x > 0$ and some positive mensurable function a, with $U(t) := \inf\{x : (\frac{1}{1-F})(x) \geq t\}$. Let k_n be an intermediate sequence of integers such that $k_n \to \infty$ and $\frac{k_n}{n} \to 0$ as $n \to \infty$. Then, as $n \to \infty$,

(i) if $\gamma < 0$, $T_\tau^* \xrightarrow{P} -\infty$;
(ii) if $\gamma > 0$, $T_\tau^* \xrightarrow{P} +\infty$.

IV. Numerical illustration

The performance of the test in the regression model

$$Y_i = \beta_0 + x_i\beta_1 + E_i, \quad i = 1, \ldots, n$$

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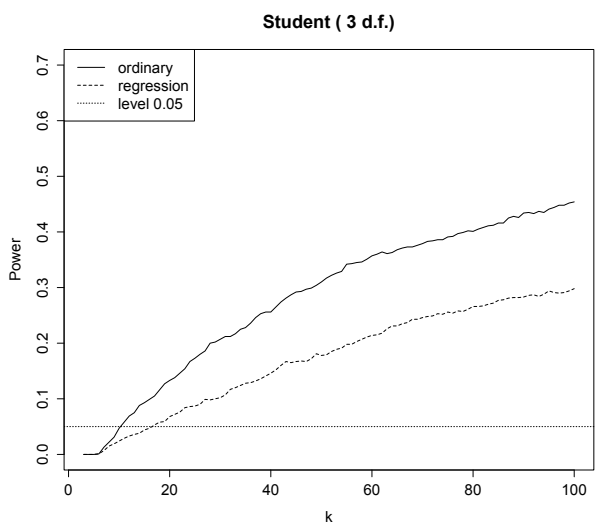

Fig. 3. Empirical power of T_τ^* and $T_{k,n}^*$ at a level $\alpha = 0.05$ for Student distribution (3 d.f.) against $\tau = 1 - k/n$, $k = 3, \ldots, 100$.

is studied on the simulated values. The power of the test is illustrated by means of the frequency of rejections under various error distributions. The chosen values of the parameter $\boldsymbol{\beta}$ are $\beta_0 = 1$, $\beta_1 = 3$. The regressors $x_1, \ldots, x_n$ were simulated for $n = 1000$ from the uniform distribution, independently of the errors, which the distributions were generated from the Pareto, exponential and Student distributions.

1000 replications of linear regression model were simulated for each case, and the test statistics T_τ^* (based on averaged regression quantiles) were computed for $\tau = 1 - k/n$, $k = 3, \ldots, 997$. Figures 1-3 show estimated type I error probability, respectively the empirical power. For comparison, the figures also show the performance of the test $T_{k,n}^*$ from (11) (based on the ordinary quantiles) applied on the i.i.d. variables E_i.

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DATA PROCESSING BY MATHEMATICAL MODELS TO SUPPORT THE DECISION ADOPTION

Cezarina Adina TOFAN

Abstract: The mathematical model is, in an unpretentious sense, an attempt for a real describing of a process or a phenomenon in a development time. Whatever the type of phenomenon considered, modelling aims to highlight analytically the fineness issues difficult to guess or even imperceptible. However, Mathematics provides ways and methods to analyse to researcher allowing pertinent explanation of the causes and effects of such phenomenological aspects less known.

Keywords: mathematical modelling, data processing, decision making.

I. INTRODUCTION

The complexity of a system is related to the size of the system (number of items, weight, etc.), the number of connections between elements, the degree of interdependence etc. Given this criterion, conventional, the systems are classified as: simple systems; complex systems; large systems.

To be listed in the class of large systems, a technical system has to perform a certain number of conditions:

- Component parts to form a whole, to perform a complex operation for optimizing a criterion (or several criteria) for efficiency;
- To contain a large number of identical or different elements connected to each other by a large number of connections;
- To operate complex, meaning that the influence function of each element of the entire system is nonlinear. The complexity of the operation is highlighted by the existence of several reaction circuits or reverse connection that intertwined in the system;
- System behaviour to depend on the action of a number of the random external factors, whose occurrence is unpredictable;
- To contain elements with self-adaptation properties for controlling the objects with variable parameters;
- Although automated, a part of the system functions to be performed by man;
- Control bodies of the subsystems to be organized by hierarchical principle.

To improve the financial planning, to forecasting efficiently and more accurate realization and spending resources, these actions are computerized and generalized are called financial planning models that are not only tools to improve forecasting but an effective support for management for a better understanding of the interactions of decisions on investment, financing and dividends[16].

Specialists have developed three alternative models of planning, analysis and financial forecasting:

- Simultaneous algebraic equations model,
- Linear programming model,
- Econometric model.

With these models, there are obtained pro-forma financial documents (balance sheet, profit and loss account, balance etc.), there is forecasted the profit per share, price per share, shares and newly issued bonds.

II, METHOD

The simultaneous algebraic equations treating the global financial planning firm, in contrast to the strict planning on a particular field, such as capital budgeting. The objective of the model is not only to optimize something, but rather to serve as a tool for providing of the significant information of the decision maker[17].

A strength point of this model of planning, in addition to that on its construction, is that it allows to the user to simulate financial impacts of changing assumptions about variables such as sales, operating indices, price-profit index, debt- own capital index and the retention rate of the profit. The advantage of using a simultaneous equations structure which represents the policies on investment, financing, production and dividends is the possibility of enlarging the capacity of interaction of the domains in which these decisions are taken.

By using the linear programming models in the financial planning, the decider sets a target function, such as, for example, maximizing the company's value based on a certain financial theory. The model optimizes the objective function under some restrictions.

At the linear programming models for financial decisions, the problem must be formulated by following the next three steps:

- Identifying the main controllable variables associated to the problem to be solved.
- Defining the objective will be maximized and defining the function based on the main controllable variables.
- Defining the restrictions, either the linear equations or inequalities of the main variables.

Linear programming is typically used to maximize the profit, rationalization the capital and for the financial planning and forecasting.

The econometric model for financial planning and analysis combines the simultaneous equations technique with the regression analysis. The econometric method models the company based on a series of predictive regression equations and then

[16] Tofan C. A., *Sisteme de asistare a deciziei bazate pe modele*, Tribuna economică, no. 6, 2009.

[17] Tofan C. A., *Sisteme de asistare a deciziei bazate pe modele*, Tribuna economică, no. 6, 2009.

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proceed to estimate the model parameters simultaneously, thus taking into account the interaction between different policies and decisions.

Techniques or econometric models involve setting and practical measuring of the functional relationships between the economic variables (for example the sales volume) and one or more explanatory variables.

Because of the large potential impact on the financial planning process and thus on the existential future of the company, the assumed planning model must be chosen carefully, the credibility of the output data depends both on the fundamental assumptions and the specific financial theory which the model is based and the ease of its use by the financial planner. The key point to assessment of any planning model is the manner in which it is formulated and constructed[18].

For a financial planning model to be useful and efficient must have the following characteristics:

- Assumptions and model results must be credible.
- The model should be flexible so that it can be adapted and expanded to satisfy a wide variety of circumstances.
- The model can be improved based on the current practice both in the technical and performance sense.
- The input and output data of the model should be understandable to the user without the supplementary knowledge (information).
- The model must take into account the relationship (interaction) between the decisions on investment, financing of the dividend and production and their effect on the market value of the firm.
- The model should be as easy for the user to operate without excessive intervention of non-financial personnel, avoiding as far as possible clunky form of the entry data.

Automatic management of production represents one of the components of an integrated manufacturing system, along with the computer aided design and the computer aided manufacturing.

Automatic management of production includes several tasks:

- planning the production schedule;
- planning the pieces quantities;
- planning the time limits and capacities;
- ordering;
- Tracking orders.

To solve the problems of production management can be used:

- heuristics techniques that do not necessarily lead to the optimal solutions;
- Technique of the operational research establishes a mathematical model to the considered process and then it is mathematically solved the resulted problem.

The most frequent problem that arises in the field of production management is to optimize a linear function subject to some linear constraints. This is the problem of the linear programming.

Example of solving an optimization problem of production using the linear programming:

Mathematical formulation of the problem of linear programming was realised for a maximization problem,

To determine the values of variables X_1, X_2,... Xn, that ensures the maximum of function:

$$F = C_1 * X_1 + C_2 * X_2 + ... + C_n * X_n \quad (1.1)$$

so that to be fulfilled the conditions (also called constraints):

$$A_{11} * X_1 + A_{12} * X_2 + ... + A_{1n} * X_n \le B_1 \quad (1.2)$$

$$A_{21} * X_1 + A_{22} * X_2 + ... + A_{2n} * X_n \le B_2 \quad (1.3)$$

.....

$$A_{m1} * X_1 + A_{m2} * X_2 + ... + A_{mn} * X_n \le B_m \quad (1.4)$$

and:

$$X_1 \ge 0, X_2 \ge 0, ..., X_n \ge 0 \quad (1.5)$$

where:

n is the number of variables;

m is the number of imposed conditions.

Function **F** determined by formula (1.1) is called the *objective function*, inequalities (1.2-1.4) are called *functional constraints* and the inequality (1.5) is called *non-negativity constraints*.

Mathematical formulation of the linear programming problem presented in the previous paragraph was performed for a maximization problem, but it can be formulated in terms of the minimization problems using the changes presented below:

If the function ***F*** must be minimized and not maximized, then the solution is:

$$\min (F) = \max (-F) \quad (1.6)$$

If the relations (1.2-1.4) are of the type "≥", the solution is multiplication by (-1);

If the relations (1.2-1.4) are of the type "=", the solution is the introduction of some supplementary variables.

If the variables can take negative values, the solution is to replace each variable with difference between two standard variables (positive).

In principle, the chosen method of solving depends on the complexity of the problem, which is the number of variables that defines the problem.

If the number of variables is at most equal to two it can be used a *graphical method*:

In the first step, it represents the admissible field in which the two variables can take the values and plot the family of lines given by the objective function. It is continued with graphical interpretation of the linear programming problems that allows classification of solutions in admissible and optimal. It can be an optimal solution, or an infinite number of optimal solutions. If the number of variables is greater than two, the graphics resolution becomes difficult or even impossible.

For the case of problems with a larger number of variables, the solution is made algorithmically by computer. The best known optimization algorithm is the SIMPLEX algorithm, able to solve the problems of huge

[18] Tofan C. A., *Decizie asistata pentru stabilirea politicii de investiţii într-o firmă*, National Symposium "Right to Welfare - Future of Romanian Economy", Faculty of Marketing and International Business, USH, Bucharest, 2011.

size (tens of thousands of variables).

Starting from the basic solution developed by G. Dantzig[19] in 1947, there have been developed several variants of algorithm, including one tabulated which is suited to small-scale problems that can be solved manually.

Because of the importance of optimizing in any field of activity, today there are many software packages dedicated to solving the linear programming problems and more.

The differences between these software packages consist in the maximum number of variables that can be treated, the interface with the user, and important in terms of integration, in an integrated manufacturing system and possibility of interfacing with other programs (databases, systems of data acquisition, etc.).

For relatively small problems, it can be used the MATLAB tool, dedicated to the optimal systems. The most current spreadsheet programs (Excel, etc.) include modules dedicated to the linear programming.

Solving an optimization problem by using Solver module in Microsoft Excel

In a production entity, a worker making moulds and dies. Each die can bring a profit of 30 euros and each mould a profit of 10 euros.

Worker wants to work maximum of 40 hours per week. To achieve dies it needs 6 hours for one and for a mould 3 hours.

The beneficiary of the products requires a number of moulds at least 3 times greater than the number of dies.

A die occupies an area of 4 times larger than the mould, and the worker have available for the storage of the made products, a room with a volume of 12 times larger than that of a die.

How must worker plan the activity so that, given the restrictions imposed to obtain the maximum profit?

Steps to resolve the problem are: the mathematical modelling of the problem and solving the mathematical model using the Solver module in Excel.

Mathematical modelling of the problem

Defining the model includes:

- Establishing the variables.
- Defining the objective function (maximized or minimized function).
- Establishing the constraints.

Establishing the variables

Either: X_M – number of moulds.

X_S - number of dies.

Defining the objective function

In this case, the objective function is the profit that must be maximized and considering the specification of the problem, it is described by the relation:

$$F = 30 * X_M + 10 * X_S \quad (1.7)$$

Establishing the constraints

According to the general mathematical model, it has to establish the relationships for the functional constraints and for the non-negativity.

Defining the functional constraints:

Total time of working:

$$6 * X_M + 3 * X_S \le 40 \quad (1.8)$$

Customer demand:

$$X_S \ge 3 * X_M \text{ or } X_S - 3 * X_M \ge 0 \quad (1.9)$$

Storage space:

$$\frac{X_S}{4} + X_M \le 12 \text{ or } 0.25 * X_S + X_M \le 12 \quad (1.10)$$

Defining the non-negativity constraints

$$X_M \ge 0 \quad (1.11)$$

$$X_S \ge 0 \quad (1.12)$$

Solving the mathematical model using Solver module from EXCEL

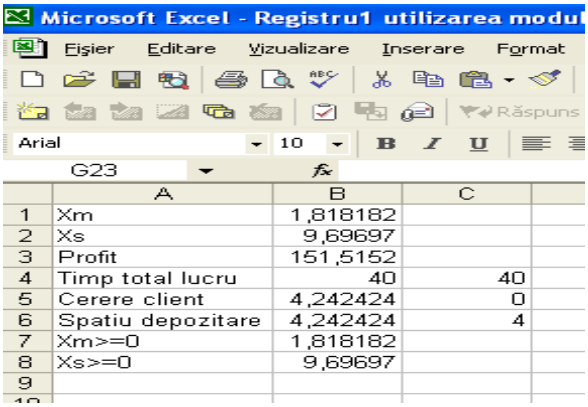


Fig. 1.1. Defining the problem in Excel

Establish the constraints:

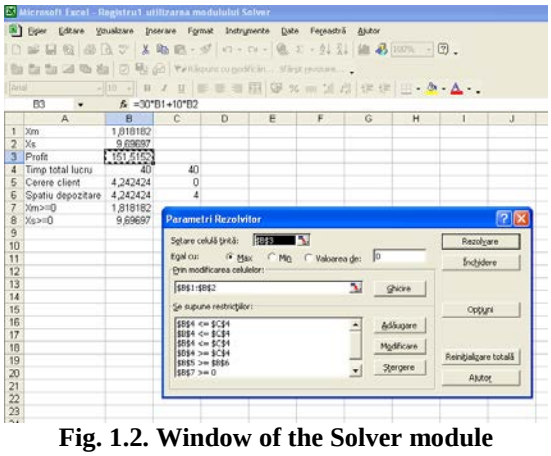


Fig. 1.2. Window of the Solver module

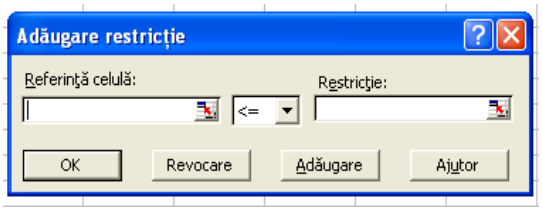


Fig. 1.3. Window for entering the constraints

[19] George Bernard Dantzig (1914-2005), American mathematician with significant contributions in the field of operational research, computer science, economics and statistics

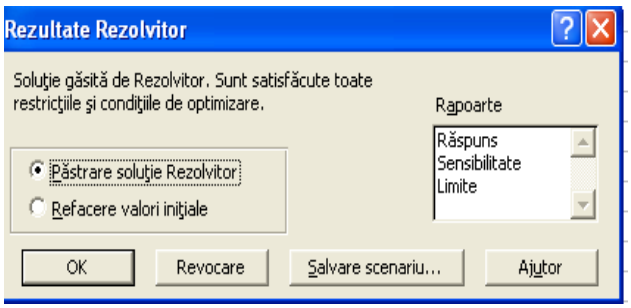
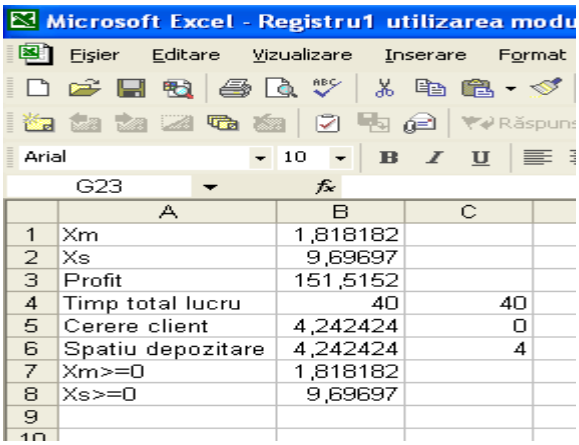


Fig. 1.4. Window for the final validation of the problem



	A	B	C
1	Xm	1,818182	
2	Xs	9,69697	
3	Profit	151,5152	
4	Timp total lucru	40	40
5	Cerere client	4,242424	0
6	Spatiu depozitare	4,242424	4
7	Xm>=0	1,818182	
8	Xs>=0	9,69697	
9			

Fig. 1.5. Excel window with the problem results

Maximum profit is achieved if the two variables are not integers numbers which not corresponding to the reality. In this case, there are adjusted the variables bringing them to integers numbers and through the repeated attempts is checking the variant which respects the imposed constraints. Maximum profit that can be obtained with respect to all constraints is 140 euro/week by achieving two dies and eight moulds, for which it will be worked 38 hours per week.

III CONCLUSION

In conclusion, the mathematical modelling can contribute to understanding and improvement the managerial decisions. Although a decision system can be extremely complex, it is good to try to build a model as simple as possible. This is achieved both by defining the limits of the analysed system so that to be considered only the essential characteristics in terms of the objective of analysing and the definition of simplifying assumptions. The model can be improved by redefining the limits and the constraints relaxation.

On the other hand, if it is tried to include in the model of all the factors and relationships, the model may become too complicated to be solved. It is therefore necessary to achieve a compromise between the necessity to build a simple model and easy to solve and necessity to get through the model a reasonable and plausible representation of the real problem.

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Authors Index

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