RELIABLE RISK OF RETUN (RRR) CRITERION: EVIDENCE OF TEHRAN STOCK EXCHANGE

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Introduction. The enormous growth in the volume of Investment in stock market worldwide has led to an increasing demand for techniques to evaluate their performance risk measurement and performance evaluation of techniques are of vital importance for investors and portfolio managers alike [Gregorious, 2007]. Managers and decision makers are always judged by the results of their decisions. In one hand, organizational managers need to increase the capability and preciseness of their used models in order to respond dynamic conditions of today markets and taking effective decisions. Additionally, rapid economic and technological growth in recent decades have changed human life seriously and have faced modern societies with complicated decision making problems [Mohammadi nejad pashaki, et al, 2014, 10-18].

In psychology, decision-making is regarded as the cognitive process resulting in the selection of a belief or a course of action among several possible alternative options; it could be either rational or irrational. Decision-making process is a reasoning process based on assumptions of values, preferences and beliefs of the decision-maker [Simon, 1977]. Every decision-making process produces a final choice, which may or may not prompt action. Multi-criteria-decision-making (MCDM) is a very important branch of decision-making theory. A decision matrix consist of criteria and alternatives and attribute of the matrix are the score of alternative with respect to each criterion .It is very important a decision matrix have criteria without conflict to each other and they be more appropriate criteria base on the subject of research.

Devising rating model and using it in Tehran Stock Exchange makes it possible for investors to distinguish more effective companies from other ones better. Therefore, they would do more rational investment and, on the other hand, the efficient portfolios can access their needed financial resources more easily and cheaply. It helps capital market to move toward efficiency [Jafari, 2015].

Measuring failure metrics is an integral part of asset management. MTTR can tell us how efficient our maintenance team is, MTBF points to the reliability of our equipment, and MTTF tries to estimate the average lifespan of non-repairable assets. These are by no means the only maintenance-related metrics. However, they are very popular, so we are giving them extra attention to MTBF and MDT.

Tracking and managing equipment and device failures is essential for any organization that relies on physical assets to deliver its product or service. It is the only way to keep operational disruptions down to a minimum. For each of the stated metrics, we will: Explain what it measures and why it is helpful, provide a graphical representation, use an example to show how it is calculated and discuss what you can do to improve it [Foskett, Rat, 2016].

Literature review. Past researchers have already applied Decision Matrix (DM) in selection problem for different manufacturing facilities using various mathematical models, heuristics and MCDM techniques. The merit of MCDM techniques is that they consider both qualitative parameters as well as the quantitative ones. MCDM includes many solution techniques such as simple additive weighting (SAW), weighting product (WP) [Azar, Rajabzade, 2012], AHP and Shannon Entropy [Bayazit, 2005, 808-819]. For this purpose portfolio manager as a decision maker needs a decision matrix that is a list of values in rows and columns that allows an analyst to systematically identify, analyze, and rate the performance of relationships between sets of values and information. The matrix is useful for looking at large masses of decision factors and assessing each factor's relative significance. The nice thing about the decision matrix is that it can apply to many different types of decisions. However, it is most effective when you or your team is comparing multiple options or criteria that need to be narrowed down to one final choice (Lucid Content Team).

1. Brainstorm the evaluation criteria appropriate to the situation.

2. Discuss and refine the list of criteria.

3. Assign a relative weight to each criterion; based on how important that criterion is to the situation.

4. Draw an L-shaped matrix.

5. Evaluate each choice against the criteria. There are three ways to do this:

a. *Method 1:* Establish a rating scale for each criterion.

b. *Method 2:* For each criterion, rank-order all options according to how well each meets the criterion.

c. *Method 3 (Pugh matrix):* Establish a baseline, which may be one of the alternatives or the current product or service.

6. Multiply each option's rating by the weight. Add the points for each option. The option with the highest score will not necessarily be the one to choose, but relative score can generate meaningful discussion and lead the team toward consensus [Tague, 2005].

A suitable criterion for DM in each research is very important. In this paper tried to propose new criterion for stock market as Criterion Reliable Risk of Return (RRR). For calculating RRR criterion need to compute the real price of company's share for each trading day, for obtain real price need to have DPS, capital increment and trading commissions. After collecting data we need to show their effects on stock price.

Real price. First thing as a base material of this research is real price of each trading day. For compute real price we need price of stock for each trading day, capital increment, DPS and trading commission. After collecting these data we must add these data to stock price for the purpose we use the below formula:

$$Real\ price = \big(coeficient\ of\ capital\ increment \\ \times (stock\ price \times trading\ commission)\big) + DPS \qquad 1)$$

Research methodologies. Real price of stock is raw material for calculating RRR criterion. RRR criterion needs methods for calculating reliability techniques like MTBF, MTTF, MDT, MTTR and MDF that they used in engineering and much science as a reliable technique.

Used techniques. Most of the methods used to calculate reliability criterion in this research these methods are used in many sciences especially in engineering. In this research tried to use them as reliable criterion in stock market.

MTBF. Mean time between failures (MTBF) is the predicted elapsed time between inherent failures of a mechanical or electronic system, during normal system operation [Lienig, Bruemmer, 2017, 45–73]. Mean time between failures (MTBF) is the sum of the lengths of the operational periods divided by the number of observed failures

$$MTBF = \frac{\sum(start\ of\ downtime - start\ of\ uptime)}{number\ of\ failures} \qquad (\\ 2)$$

MDT. Mean down time (MDT) can be defined as:

$$MDT = \frac{\sum(start\ of\ uptime - start\ of\ downtime)}{number\ of\ failures} \qquad (\\ 4)$$

For example, an asset may have been operational for 1,000 hours in a year. Over the course of that year, that asset broke down eight times. Therefore, the MDT for that piece of equipment is 125 hours (Hilt, 2016, 74-75).

MDF. Mean Days Failures MDF is new method for calculating reliability criterion that proposes in this research. It shows ratio fail days in total days that asset in use.

$$MDF = \frac{total\ number\ of\ fail\ days}{total\ number\ of\ trading\ days} \qquad (\\ 6)$$

This is very useful because MDF in stock market never become zero or infinite.

Rumina. Normalize decision matrix with Rumina method. In different methods, there are multi-criteria with positive criteria (benefit) and negative criteria (loss). A normalization method has been proposed in this field called Rumina method. For

positive criteria, divide the value of each criterion by the largest value of that criterion. For negative criteria, the smallest value of that criterion is divided by the values of each criterion [Habibi,2018].

$$n_{ij} = \begin{cases} \dfrac{x_{ij}}{max \ x_{ij}}, & C_j > 0 \\ \dfrac{min \ x_{ij}}{x_{ij}}, & C_j < 0 \end{cases} \qquad\qquad 4)$$

Population and sample. The process of selecting alternatives is choosing companies from the listed companies in Tehran stock exchange with some rules likes they have worked more than 6 years, different industries, their shares are traded in the market every year and their data be available like trading days, capital increment and DPS. In this research ten companies selected form this list.

Data collection method. Collecting information done based on return of companies. The important things are closing price for each trading day, capital increment and DPS. For obtain these information used reputable and reliable sites that belong to the Tehran Stock Exchange itself. The data are used in this research include closing prices, capital increment and DPS from 1393 to 1399 solar calendar (2014 till 2020) of ten companies of Tehran Stock Exchange. All this information can change closing price but there are other things that to make data more accurately are buy and sell commission. Buy and sell commission in the closed price at the end of the each trading day calculated it can help investors to know accurate return of company. After collecting data, the process on them begins to convert them to useful data for this research. For this purpose, first must change closing price after capital increment, DPS and buy and sales commission.

Data analysis. For analyzing data that collected must use them in reliability methods and find result. For this purpose, define these methods for stock market. System failure is the days that price of share is less than specific price that investor determined as a minimum gain of investing and number of failures is number of period of failure in specific period that investor determined it. Operation system is the days that stock return more than investor determined profit. The role of real price is very important to calculating the system operation and system failure.

Frist step: investors must determine the amount of profit that they expect in a year then calculate the parameter the mandatory Materiel Reliability (RM). RM defines expect amount profit of investment which the stock price can satisfy. Supposed expected profit for one year is twenty percent.

Table 1. Calculated RM and failures and operations day for a company

Faravar Company	RM	Total of trading Days	Fail Number	Fail Days	Operation Days
1393	5685	236	4	128	108
1394	3257	210	1	210	0
1395	3090	210	2	46	164
1396	11718	236	1	92	144
1397	18049	235	1	92	143
1398	39294	207	5	84	123
1399	21529	239	4	34	205

Second step: calculating total days that stock traded.

Third step: compute total fail and operation days and number of system failure.

Fourth step: use reliability methods MDT, MTBF, MDF in two modes annual and average of annual.

$$MDT = \frac{\sum(Operation\ days)}{number\ of\ failures} \tag{8}$$

MDT defines how many days the stock price is traded above that certain amount that specified by investor for each system failure.

$$MTBF = \frac{\sum(Fail\ days)}{number\ of\ failures} \tag{9}$$

MTBF defines how many days the stock price is traded less than certain amount that specified by investor for each system failure.

$$MDF = \frac{\sum(fail\ days)}{total\ number\ of\ trading\ days} \tag{10}$$

MDF defines mean days failures, system failures are days the stock price is traded less than certain amount that specified by investor for each period time. MDF is total failure days divide to sum of the trading days.

After compute amount of MTBF, MDT and MDF for each company annually then calculate average of each year with previous years. AS an example of MDF technique the result is in the table below:

Table 2. calculated RRR criterion for 10 companies for 5 years

	MDF PER YEAR										
Reliability	Faravar	Behbahan	DPI	Shefan	Hafari	Hekashti	Lebutan	GheShekar	Bekab	PeShand	MIN
1395	0.22	0.59	0.44	0.74	1.00	1.00	0.94	1.00	1.00	0.74	0.22
1396	0.39	0.97	0.24	0.59	1.00	1.00	0.81	0.13	0.31	0.29	0.13
1397	0.39	0.18	0.79	0.21	0.32	0.85	0.44	0.43	0.94	0.47	0.18
1398	0.41	0.11	0.15	0.23	0.07	0.47	0.08	0.12	0.07	0.14	0.07
1399	0.14	0.07	0.02	0.03	0.09	0.12	0.07	0.06	0.23	0.03	0.02

This table shows result of computing RRR criterion for reliability of companies by MDF technique. As it is clear, minimum number of each year that related to a company explains the company is more reliable of other companies.

Table 3. calculated RRR criterion with average mode for 10 companies for 5 years

MDF AVERAGE											
Reliability	Faravar	Behbahan	DPI	Shefan	Hafari	Hekashti	Lebutan	GheShekar	Bekab	PeShand	MIN
1395	0.22	0.59	0.44	0.74	1.00	1.00	0.94	1.00	1.00	0.74	0.22
1396	0.30	0.78	0.34	0.66	1.00	1.00	0.87	0.57	0.66	0.52	0.30
1397	0.33	0.58	0.49	0.51	0.77	0.95	0.73	0.52	0.75	0.50	0.33
1398	0.35	0.46	0.40	0.44	0.60	0.83	0.57	0.42	0.58	0.41	0.35
1399	0.31	0.39	0.33	0.36	0.50	0.69	0.47	0.35	0.51	0.34	0.31

The above table shows result of average of previous years. Minimum number of each year determines the company is more reliable of other ones.

Fifth step: find the best company of each method and construct portfolios by result of each method. Company that MDF recommended as per year type is:

Table 4. Recommended the best company for each year with per year mode of MDF

MDF		
Year	**Recommended**	**Return**
1396	Faravar	56
1397	GheShekar	153
1398	Behbahan	353
1399	Bekab	363
1400	DPI	

Company that MDF recommended as average type is:

Table 5. Real return of recommended companies for each year with MDF average mode

MDF		
Year	**Recommended**	**Return**
1396	Faravar	56
1397	Faravar	112
1398	Faravar	214
1399	Faravar	100
1400	Faravar	

Annual Portfolio that MTBF recommended for 1398 as per year mode of MTBF is:

Table 6. Constructed a Portfolio with per year mode of MTBF

1398	MTBF	Normalized (RUMINA)	Weight	Return
Faravar	92.00	0.26	0.05	10.34
Behbahan	41.00	0.59	0.11	38.29
DPI	37.20	0.65	0.12	44.72
Shefan	49.00	0.50	0.09	10.03
Hafari	24.33	1.00	0.18	33.55
Hekashti	203.00	0.12	0.02	4.86
Lebutan	102.00	0.24	0.04	16.45
GheShekar	24.75	0.98	0.18	82.45
Bekab	105.00	0.23	0.04	29.90
PeShand	27.25	0.89	0.16	84.38
SUM		5.475	1.00	354.98

Portfolio that MTBF recommended for 1398 as average type is:

Table 7 Constructed a Portfolio with average mode of MTBF

1398	MTBF	Normalized (RUMINA)	Weight	Return
Faravar	69.00	0.33	0.09	19.47
Behbahan	88.17	0.26	0.07	25.15
DPI	22.54	1.00	0.28	104.24
Shefan	111.00	0.20	0.06	6.25
Hafari	139.78	0.16	0.04	8.25
Hekashti	120.90	0.19	0.05	11.52
Lebutan	80.43	0.28	0.08	29.46
GheShekar	74.92	0.30	0.08	38.47
Bekab	117.93	0.19	0.05	37.60
PeShand	32.86	0.69	0.19	98.81
SUM		3.591	1.00	379.22

Sixth step: Compare results of recommended company and portfolios by each method in two types. In this step we compare return of each method as a recommended company and portfolio by two style of calculation per year and average for ten companies that selected from the list of companies in Tehran Stock Exchange.

Seventh step: to make a decision to recommend a method that had better performance of other. Now it is time to find the best portfolio and company with these companies. It means each changing to companies make a different result. To choose a company or portfolio depends on investors. Obviously choosing one company for investment has more risk than portfolio that system recommends.

Result and discussion. In this section show return of each method that calculated RRR criterion as a chart for compare them easy. MDT, MTBF and MDF are methods that used for calculating RRR criterion that proposed in this research. For understand ability of this criterion we needed to use it in real example of Tehran Stock Market. Assumed we have ten alternatives and only one criterion and RRR calculated by different reliability methods. Compare return of each method can be good criterion for obtaining RRR performance. The below charts shows return of them in different situation and last chart compare best reliability method with return of Bank, Stock Market Index.
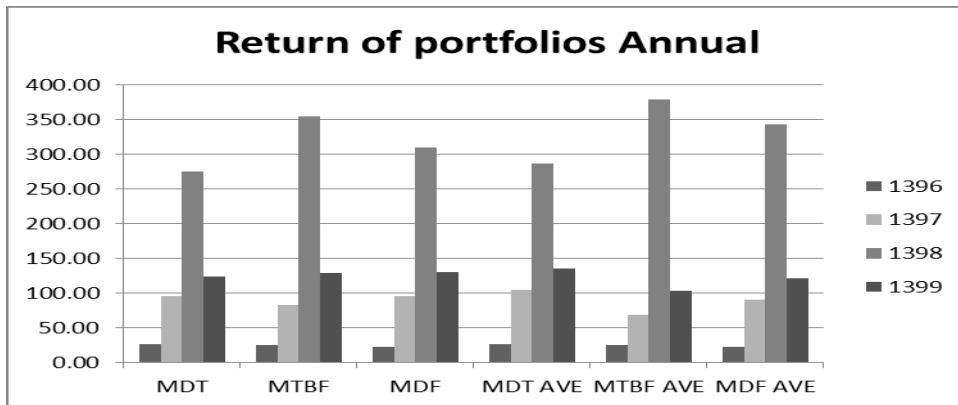
Figure 1. Comparing annual returns of each reliability methods from 1396 to 1399

This chart shows return of each method from 1396 to 1399 that system recommended. It seems MTBF has performed better than other.
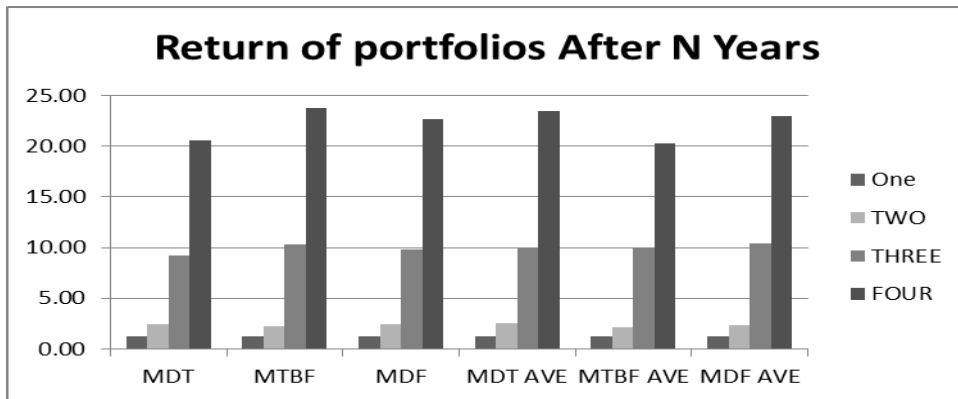

Figure 2. Compared returns of each portfolio after N years

This chart shows return of each method from 1396 to 1399 that system recommended. It seems MTBF has performed better than other. After four years it had has highest efficiency.
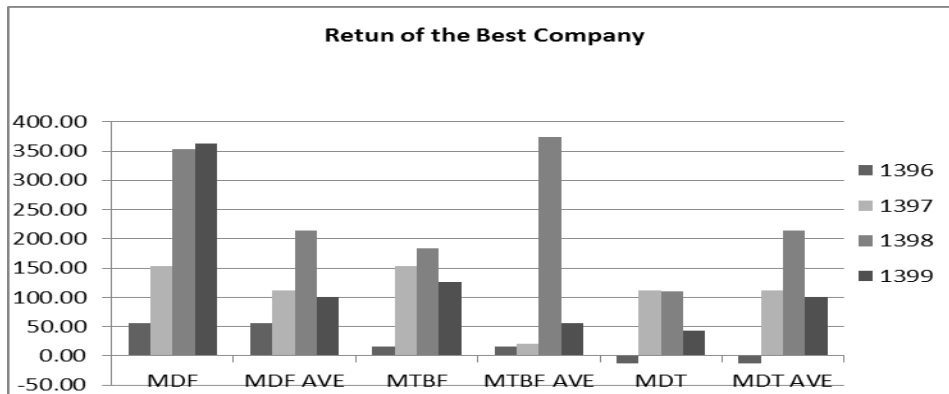
Figure 3. Compared annual returns of the best company from 1396 to 1399 that recommended with each method.

This chart shows return of each method from 1396 to 1399 that system recommended invest on only one company has better return. It seems MDF has performed better than other to recommend company for investing.
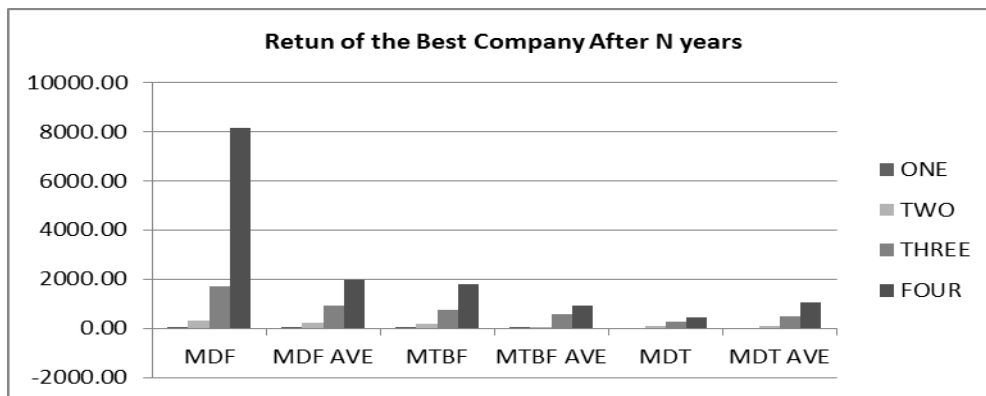

Figure 4. Compared returns of the best company after N.

This chart shows return of each method from 1396 to 1399 that system recommended invest on only one company has better return. It seems MDF has performed better than other to recommend company for investing. After four years it had has highest efficiency.
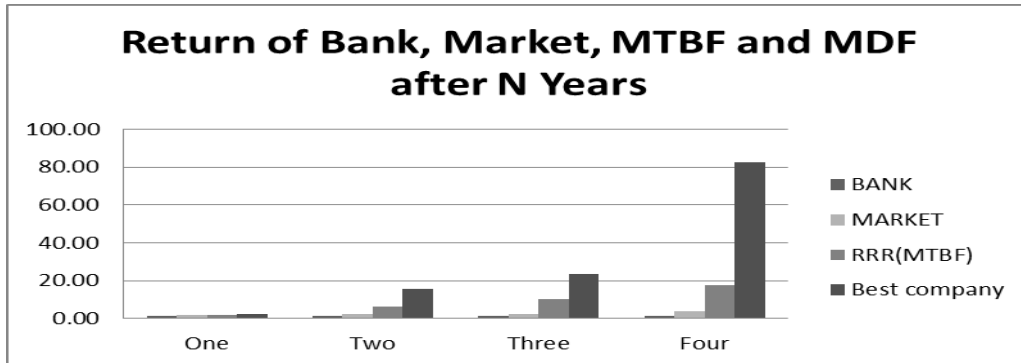
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Figure 5 Compared returns of Bank, Market, portfolio with (MTBF) and the best company that recommended with MDF after N years.

This chart shows return of BANK, Stock Market Index, and MTBF as the best method for construct portfolio and MDF as the best method to recommend the best company. MDF has the good performance to recommend the best company as a high risk investing it is good for risky investor.
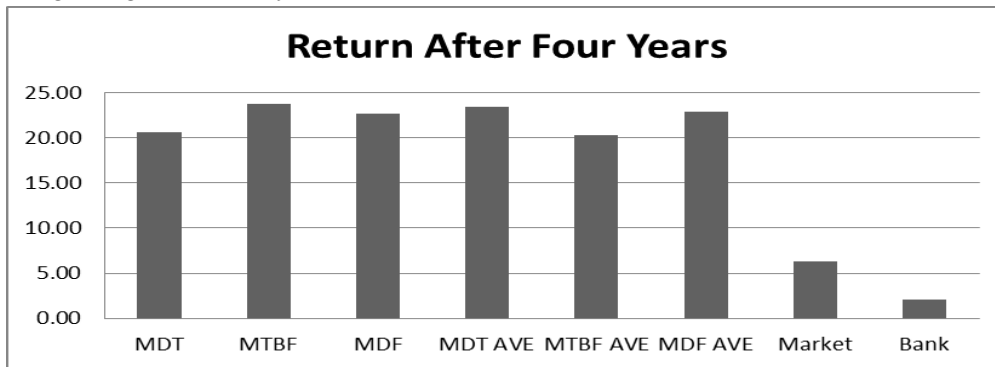

Figure 6 Compared returns of Bank, Market and portfolios constructed with MDT, MTBF MDF in two modes per year and average after four years.

Table 8. Recommended portfolio for 1400

1400	Weight
Faravar	0.08
Behbahan	0.04
DPI	0.14
Shefan	0.12
Hafari	0.19
Hekashti	0.13
Lebutan	0.04
GheShekar	0.12
Bekab	0.04
PeShand	0.10
SUM	1.00

MTBF has the best performance and it can recommend the portfolio with high return and these portfolios are proper for low risk investing and risk-averse investor. The company for investing that MDF (annual) recommended is DPI and The portfolio is recommended MTBF (annual) for constructing the portfolio for 1400 (from March 2020 to March 2021) is in table 8.

Conclusion. This paper has used two of famous Reliability's techniques MTBF, MDT and proposed a new method MDF. Companies from different industries that listed in Tehran Stock Exchange and all methods that used to calculating RRR criterion were succeeded to mitigate their downside risks and increase their return but investing in bank and stock market could not do such work. The results determined in figure 6.

MDF that is suitable more than other method it can recommend a company with high return. On the other hand, if investors want to make a portfolio, MTBF has stronger performance to construct portfolio with only RRR criterion than other techniques. At the end, the article recommends a company and a portfolio for next year.

This paper can be useful to research in future and different type of investors like funds, brokers, risky and risk-avert and beginner investors.

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Reliable Risk of Return (RRR) Criterion: Evidence of Tehran Stock Exchange
Key words: Portfolio, MCDM, Criteria, MTBF, MDT, MDF

This study evaluate a new criterion with high efficiency and useable in decision matrix as a criterion with quality in Multi Criteria Decision Making (MCDM) methods. This research discusses several concepts such as reliability techniques, MCDM, normalizing with Rumina, decision matrix (DM) and real return. This paper proposes a criterion Reliable Risk of Return that is called RRR. This criterion can show how investor can trust to share of the companies that their return more than specific amount that investor defines it. For this purpose, by applying a creative to use reliability techniques that usually used in other science specially engineering. Tehran Stock Exchange it means in the studied period, it can recommend the best company with highest return. In other hand, RRR calculated with MTBF can recommend the portfolio with highest return.

Արաշ Ջահան ԲԻԳԼԱՐԻ
Վստահելի վերադարձի ռիսկ (RRR) չափանիշ. Թեհրանի ֆոնդային բորսայի ապացույցներ
Բանալի բառեր. պորտֆոլիո, MCDM, Չափանիշներ, MTBF, MDT, MDF

Այս ուսումնասիրությունը գնահատում է բարձր արդյունավետությամբ և որո-շումների մատրիցայում կիրառելի նոր չափանիշ՝ որպես որակի չափանիշ բազմաչափ որոշումների կայացման (MCDM) մեթոդներում: Այս հետազոտու-թյունը քննարկում է մի քանի հասկացություններ, ինչպիսիք են հուսալիու-թյան տեխնիկան, MCDM, նորմալացումը Rumina-ով, որոշումների մատրիցը (DM) և իրական վերադարձը: MDF տեխնիկան ձեռք է բերում Թեհրանի ֆոն-դային բորսայում ամենաբարձր եկամտաբերություն ունեցող ընկերություննե-րը, ինչը նշանակում է, որ ուսումնասիրված ժամանակում այն կարող է առա-ջարկել ամենաբարձր եկամտաբերությամբ լավագույն ընկերությունը: MTBF-ով RRR-ն կարող է առաջարկել բարձր եկամտաբերությամբ պորտֆելը:

Араш Джахан БИГЛАРИ
Критерий надежного риска возврата (RRR): свидетельства Тегеранской фондовой биржи
Ключевые слова: портфель, MCDM, критерии, MTBF, MDT, MDF

В этом исследовании оценивается новый критерий с высокой эффективностью, который можно использовать в матрице решений в качестве критерия качества в методах принятия решений по нескольким критериям (MCDM). В этом исследо-вании обсуждаются несколько концепций, таких как методы надежности, MCDM, нормализация с помощью Rumina, матрица решений (DM) и реальная доходность. Для этого, применяя креатив, можно использовать методы надежности, ко-торые обычно используются в других науках, особенно в технике. Это исследова-ние предлагает новый метод, который поможет инвесторам выбрать лучшую ком-панию из списка компаний, а также рекомендовать прибыльные портфели.