

A Method Based on the Improved Kepner-Tregoe Program for Risk Identification: Proposals and Evaluation of the Method

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Abstract: Recently, project risk management attracts all the attention in order to raise success probability of a project. The authors take up the risk management of a project, above all, risk identification, and show a concrete implementation method based on the improved Kepner-Tregoe Program. They perform laboratory experiments on risk identification using the proposed method. Moreover, they compare the proposed method with the widely known method based on the brainstorming and the original Kepner-Tregoe Program.

Key-Words: Risk Management, Risk Identification, Project, Kepner-Tregoe Program.

1 Introduction

Recently, project risk management attracts all the attention in order to raise success probability of a project. In PMBOK Guide [1], the enforcement process of risk management consists of "Risk Management Planning," "Risk Identification," "Qualitative Risk Analysis," "Quantitative Risk Analysis," "Risk Response Planning," and "Risk Monitoring and Control" is defined as consisting of six processes. And the concept is known widely. However, there are few documents, which describe about a concrete enforcement method in detail of these processes, and it is not rare for a method to be different by a person carrying it out. Therefore, in the case carrying out risk management mostly, the precision of the management depends on capability / technology / experience of the members participating in a project, and it is a problem. Especially risk identification is a posteriori process. It is easy to produce unevenness with members in precision of the risk identification than the other work processes when carrying out risk identification without introducing an objective index. Furthermore, it will overlook the risks that are a potential problem if there is deficiency in risk identification. If the examination of this part is light, even if analysis no matter how precisely is done, afterwards, the result of the risk management harms reliability remarkably. The risk identification can be said to be a very important process in risk management from the above-mentioned things. Furthermore, depending on a project, there are times when you must carry out risk management extremely in a short time because

of emergency. For example, in the software development projects, the resources for work are cut to satisfy customer requirement conditions, and there is not enough time to carry out risk management. In addition, in the obstacle project to recover the obstacles in a limited time by the counter measures all the resources of the project are taken, and there are cases when the risk management of the recovery work itself becomes insufficient. The problem of not securing enough enforcement time for risk management is not a problem which occurs only in the specialty domains that were extremely limited such as anti-software development project and obstacle measure projects, but the problems occurs in various projects. From the above-mentioned, the project distinguishes risks precisely effectively in limited time, and it is important to grasp them, and to take measures.

So, in this research the risk management in a project is taken up. In the Kepner-Tregoe Program [2], we selected only the potential problem analysis (potential problem analysis is hereafter called KT-PPA) and by using it strictly improved the solution of the problem in risk identification. While proposing the concrete methods of operation of risk identification based on improved KT-PPA in this paper, the validity is also shown. The composition of this paper is shown below. In Section 2, while describing the status quo of the related research on the concrete methods of operation of risk identification, the problems are clarified. And the purpose of this paper is mentioned after an appropriate time. In Section 3, concrete enforcement

methods are taken and explain KT-PPA. The section 4, proposes concrete methods of operation. About risk identification, improved KT-PPA is shown and its usage is suggested. Based on these, shown are concrete methods to solve the problems that were shown in Section 2 after appropriate time. In Section 5 the experiments are done and their results are shown. In Section 6, are shown the effectiveness of the enforcement methods of the risk identification that were mentioned in Section 4 by evaluating the experiment result and possibility of the realization. Basically, by comparison of 3 things, widely used brain storming [1] [3] in risk identification, original KT-PPA and improved KT-PPA, shows that improved KT-PPA is the best. In the end, the conclusions of this paper and remaining problem points are described in Section 7.

2 Risk identification related research, and the purpose of this paper

2.1 Risk identification related research

In PMBOK Guide [1], it is defined [Risk Identification determines which risks might affect the project and documents their characteristics.]. Milosevic [4] says, [The purpose is to find all the risks of having serious influence for the success of a project], then especially henceforth, it discusses by investigating the work of a risk in the process of risk identification.

About the investigation of the risks, some concrete enforcement methods are already suggested although not many. Kino [5] nominates [check list, interview of the intelligent people, brainstorming] as general method used presently for investigation of the risks. And give below the explanation about each method, and the problems when applying to the project are described.

Checklist is a risk table, and continues being advantageous in grasping risks at a glance, but there are problems, which cannot be dealt because of the risk leakage from the checklist. It cannot support in particular the special situation of the individual project.

The interview of intelligent persons is a technique to investigate risks by interviewing the person who experienced similar projects in the past or staff who have good knowledge in the field. It takes time and cost for interview to be efficient to make use of knowledge and the experience of other persons, and

there are problems that it is difficult to hear the effective opinions about the novelty of the project

Judging from the viewpoint to investigate risks, the brainstorming can become the most useful tool. However, like the interview of intelligent people, there is the danger that the leakage of risk investigations occurs because it is the method that depends on personal experience and knowledge. In addition, because the brainstorming is performed by protecting 4 rules, ("no criticism at all", "freedom", "demand quantity", "combination /improvements") [3], in the investigated results there are chances of information unrelated to risks being included.

- It is easy to depend on capability, technology, and experience of the members who take part in the project.
- Information unrelated to risks is easy to be included in the investigated product.

Fig. 1 The demerits of brainstorming.

Now, these concrete methods of operation can be classified into the three following types.

- (1) Method which depends on the technical field is limited extremely like the software development project, McManus [6] CMU [7], Boehm [8], Kado [9]
- (2) Method which depends on the limited technical field like the project: PMBOK Guide [1], Royer [10], Smith et al. [11], and Tajima [12] and Kino [13]
- (3) General-purpose method which is not limited to a project and can be used in all fields: Kepner et al. [2] and Hoshino [3]

Checklist or interview of intelligent people can be classified into (1) and (2), and brainstorming and KT-PPA can be classified into (3).

2.2 Purpose of this Paper

Since there are strong and weak points in each of the methods taken up in 2.1, it is better to use two or more methods together to reduce the leakage of risks identification.

For example, in a software development project, not only software, but also the apparatus, which runs the software and people who do work, need to be considered as the object of risk management, many things need to be handled. If risk information is collected based on the method depending on a technical field after collecting risk information based on general-purpose method, it is more extensive and it is considered with less leakage for risk information.

However, since a project is unsteady work, it can be said that the risk identification method dependent on the technical field cannot be used always. Therefore an opportunity to collect risk information only by a general-purpose method in a project increases.

However, since a problem (Fig. 1), which was described in 2.1 is among the brainstorming generally used as a general-purpose method, when using in a project, risks may not be extracted effectively.

That is, if defects are found in the inquiry of risks based on the brainstorming, which is a general-purpose method, potential problems of risks will be overlooked, and if examination of this portion is not deep, even if further analysis is precise, the results of risk management will spoil reliability remarkably.

Therefore, extract arguments only to the phase, which applies the general-purpose method for risk identification in this paper, and as a general purpose method for risk identification widely used as concrete methods of operation for solving the problems which the brainstorming has, it proposes using the method which improved the rational thinking method for the management called the Kepner-Tregoe Program (only for "potential problem analysis"), and that validity is verified.

3 Kepner-Tregoe Program

The Kepner-Tregoe Program is the "Kepner-Tregoe rational process." Both the psychologist Charles H. Kepner and sociologist Benjamin B. Tregoe discovered that "the prominent decision-making, have the common element of information collection, analysis and judgment process". And systematized this for easy to use for the scene of management as the rational thinking method (thinking procedure). This Kepner-Tregoe Program intends for making conclusion in everyday business by considering all the thinking domains for the kind of the problems that should be settled by using 4 analysis, problem analysis, decision analysis, potential problem analysis, and Situation analysis. The role of each analysis method is as follows.

(1) Problem analysis (PA): The problems that stopped succeeding suddenly from a certain point in time, the cause are studied.

(2) Decision analysis (DA): For the objective achievement, the optimum one is selected from two or more choices.

(3) Potential problem analysis (PPA): While analyzing future risks from known information at

present, the policy for avoiding or reducing risks in advance is drawn.

(4) Situation analysis (SA): For each of the partial problems analyzed by given problems, which analysis method from (1) - (3) to be applied is clarified, and in what order they should be applied is drawn.

The Kepner-Tregoe Program is constituted as mentioned above from four analysis methods. However, each of them differs in objectives and also in application procedure respectively. For this reason it is not appropriate to treat them same in confusion under the name of Kepner-Tregoe Program

Therefore, only selected potential problem analysis of the technique for risk management from the Kepner-Tregoe Programs in this research, for extraction and discussion. About the KT-PPA, although there is advanced research by Takata [14], Altier [15], Sawai [16], Komiya et al. [17], there is still no report taken up about improvement of KT-PPA this time.

By the way, the risk identification of KT-PPA is a kind of checklist method [3]. In KT-PPA "the dangerous place" that seems to bring bad influence for the achievement of the enforcement plan is called vulnerable areas. The high part of the probability that the problem, which is likely to be brought up will occur is defined as a vulnerable areas, and the following [R1] - [R6] are mentioned as vulnerable areas in KT-PPA. And if a risk is probed centering on these areas based on the fact that such areas exist in a project, it is supposed that risks can be probed effectively.

[R1]: The point that is filled with inexperienced elements.

[R2]: The point where resources required for work are restricted

[R3]: The point where time restrictions are especially severe

[R4]: The point, which is easy to receive environmental change

[R5]: The point where two or more sections are involved.

[R6]: The point where who is responsible is not clear. It is thought that these are effective in narrowing the search space of the risks.

4 About the methods of operation of risk identification

In order to solve the problems mentioned in Section 2 in this paper, propose the method of risk identification with improved KT-PPA. In order to explain this method, the concrete example of project,

(Fig. 2) [2] and workflow (Fig. 3) show the procedure of risk identification. The workflow (Fig. 3) is the improved form of original workflow of KT-PPA.

The inauguration of the research institute of a government organization was cut down several weeks afterward, and the bureaucrat who ordered management probed the risk.

Fig. 2 An example case of a project for risk identification.

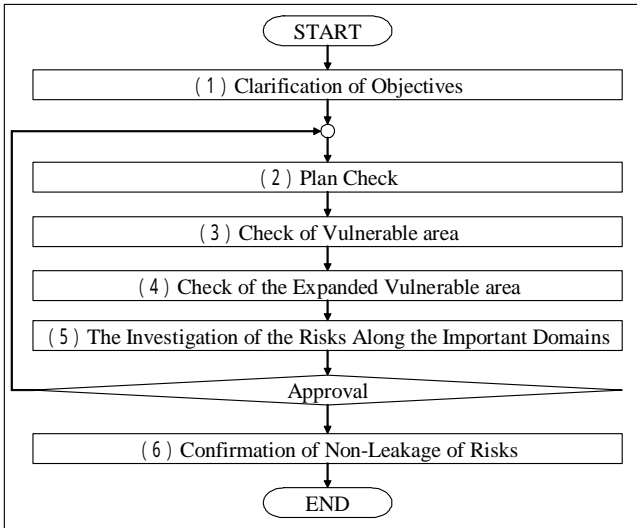


Fig. 3 A workflow of the risk identification.

(1) Clarification of Objectives

Risk management objectives are clarified. . "What will be performed, how much and when?" is clarified. Multiple government offices and high official of several countries are going to attend, without any revision. The bureaucrat in charge of completion ceremony administration had an aim to "let a completion ceremony succeed".

(2) Plan Check

In order to assume future risks, the contents of a plan of a project are checked. The bureaucrat acquired the fundamental information about an inauguration.

- Many high officials are going to be present as guests on the day.
- The building of the research institute was not built to accommodate many people.
- Since this organization was taking charge of the high scientific inquiry of concern, surrounding expectation also seemed to be great and the visitor were likely to be many.
- Kramer senator is to make a primary policy speech.

- Since millions dollars of fund is already injected so failure is not allowed in the inauguration event.

Moreover, when the day schedule was checked, it was found that an inauguration consisted of the "opening ceremony", "speech", "lunch", "inspection of institutions", and "unveiling ceremony" as in (Fig. 4).

	9	10	11	12	13	14	15	16	17
Opening ceremony									
Speech									
Lunch									
Welcome Address									
Inspection of Institutions									
Unveiling Ceremony									

Fig. 4 Schedule of the day of inauguration ceremony

(3) Check of vulnerable areas

In order to probe a risk, the vulnerable areas of a project are checked.

The bureaucrat checked the vulnerable areas of the project along the vulnerable areas of KT-PPA as follows.

- [R1]: Correspondence of confusion
- [R2]: The size of institutions
- [R3]: Time distribution of a program
- [R4]: Correspondence of the weather
- [R5]: Correspondence of institution inspection
- [R6]: Correspondence of lunch

In addition, about each of the vulnerable areas mentioned in Section 3 above, how they will be interpreted in this applicable area and corresponding area for each is raised. However, depending on an application area, about the vulnerable areas mentioned in Section 3, it is possible that there is no applicable area or there are many.

(4) Check of the extended vulnerable areas.

The vulnerable areas of original KT-PPA shows the investigating index of the risk around the point where the probability that a problem occurs is high. However, as by the probability and impact matrix [1] or as in the proposal of Smith et al [11], the general risks are evaluated by occurrence probability and the size of damage when it is obvious to happen. This shows that not only with high probability of occurrence, but with the degree of damage of occurrence can be dangerous risk. In other words

there are dangerous risks for the risks that occur with big damages even for things with low outbreak probability. However, in the instructions of original KT-PPA, even for risks which may become big with the damage of occurrence, there is no mentioning of investigating the things with low occurrence probability, so such risks are not investigated and the damage may be big. From such thinking, the new index that we show in figure 5 in the vulnerable areas of original KT-PPA, we propose to add the index [R7], with more detailed indices [R7-1], [R7-2], and [R7-3]. Because from the quality of the project point, giving minus affects to the objectives of the project are giving "low quality", "high cost", and "late delivery". Regarding this we improved the original KT-PPA.

[R7] The point where the possibility to occur is low, but a serious loss occurs when it happens.
 [R7-1]: The point where a serious quality fall occurs.
 [R7-2]: The point where serious excess cost occurs.
 [R7-3]: The point where a serious appointed date of delivery gets delayed.

Fig. 5 An area to add newly to vulnerable area.

The bureaucrat checked the vulnerable areas of the project along the extended vulnerable areas.

[R7]: Progress and the expense of the completion ceremony.

(5) The investigation of the risks along the vulnerable areas.

Along vulnerable areas, risks are investigated. About the investigation work, without being particular about quality of the information such as description methods, collect as many risks as possible

The bureaucrat applied above-mentioned [R1] - [R7], and probed the risks of eight affairs shown below.

- 1) Was in confusion so applied ([R1]) for where should the people go, and what is good to do.
- 2) Applied ([R2], which is for unsuitable establishment to treat a lot of attendants.
- 3) Applied ([R3] for member of the diet and VIP who may not attend as per program.
- 4) Applied [R4] for hindrance of rain or a strong wind for progress.
- 5) Applied [R5], in the institution for announcement of research results, where there was a scramble to get the place.
- 6) Applied ([R6] for eating the lunch menu within unsuitable limited time.

7) Applied ([R7] for person in charge who didn't grasp detailed progress.

8) Applied ([R7], which exceeds the budget that planned at first by doing gorgeous direction.

(6) Confirmation of non-leakage of risks.

By reviewing the investigation of risks, confirm that there are no omissions of investigations. The bureaucrat did the investigation of the risks along vulnerable areas and planned a review.

By above-mentioned procedures, it was possible to investigate the risks of the project to hold a completion ceremony. This way by using the improved procedures of KT-PPA, it was possible to investigate the risks within limited time, and manage them effectively.

5 Check of an application experiment and its validity by it

When the 3 methods, brainstorming method (Strictly it is card BS Law. Card BS Law is hereafter called brainstorming. Card BS Law method is known as individually available brainstorming method.) and the original KT-PPA and improved KT-PPA are compared, the improved KT-PPA method proves to be more effective.

5.1 The method of an experiment

[Environment of the experiment]

Because it was not rare to perform the risks identification of the project alone, one person did a comparison test for risks investigation. When risks investigation was done, then opinions were not exchanged with other subjects.

[The subjects used for the experiment]

Three problems were selected to study the risks identification on testing. The summary of the problems is shown in Figure 6, Figure 7, and Figure 8 each. These problems intend that there is a possibility that members will face high level of work items when a project is pushed forward. In addition, we took up the work item (Figure 6) by the software development project and the work item (Figure 7, Figure 8) by the trouble-shooting project to show that we could apply the improved KT-PPA method universally. In addition, we decided to take up two trouble-shooting projects of the emergency because there was not enough time to carry out risk identification by the real risk management. By the way, these problems are based on daily work experience, so that it is easy for subjects to remember.

On the Web server of the research room, the applications are being developed. In order to judge the normal operation of the applications, the developer requested another worker to check that there were no grammatical errors. The developer gave the source codes of the applications to a worker in writing. The worker will perform the visual confirmation of the source codes from now.

Fig. 6 A work item of a software development project (Problem 1)

When the file server of the research room was checked, it was confirmed that the Access Privileges of the server were not appropriate. It was found that the software under development in the research room sets the Access Privileges. Investigation results proved that there were problems for setting. The settings were changed urgently

Fig. 7 A work item of a trouble-shooting project 1 (Problem 2)

When the file server of the research room was checked, it was confirmed that the Access Privileges of the server were not appropriate. It was found that the software under development in the research room sets the Access Privileges. Investigation results proved that there were no problems for setting. Reboot of the software or the reboot of the server is necessary to correct them, so repair work need to be done urgently.

Fig. 8 A work item of a trouble-shooting project 2 (Problem 3)

[The allotment method of the subjects and the work contents of each group.]

Total of 25 persons were allotted as subjects in 5 groups, each with 5 persons. Three groups, Group α , β , δ were divided so that the ability of the subjects between them was uniform. In addition, two groups of group γ and ε were grouped so that the ability of the subjects between these became uniform.

The contents of work of each group and the subjects of each group are as follows. In addition, in the experiment, with the experience of risk management less than a year, were defined Beginner Class, from 1-5 years were defined as Middle Class, and more than 5 years were defined as Upper Class.

Group α :

Five beginners' class persons who have been engaged in the same project for more than 1 year were made into the subjects to investigate the risks with improved KT-PPA.

Group β :

Five beginners' class persons who have been engaged in the same project for more than 1 year were made into the subjects to investigate the risks with original KT-PPA.

Group γ :

Five middle-class persons who have been engaged in the same project as for more than 1 year were made into the subjects for investigating the risks with original KT-PPA.

Group δ :

Five beginners' class persons who have been engaged in the same project for more than 1 year were made into the subjects to investigate the risks with brainstorming.

Group ε :

Five middle-class persons who have been engaged in the same project for more than 1 year were made into the subjects to investigate the risks with brainstorming.

[The enforcement procedures of the experiment]

The experiment measured the results of the effects of each of the 5 groups and compared them. The enforcement procedures of the experiments are as follows.

STEP1:

The subjects are assembled, and the method of investigating the risks is defined. Explanations are made until all the participants understand how to probe risks.

STEP2:

The subjects are assembled and the outlines of the project taken up for the experiment are explained.

STEP3:

The subjects perform risks investigations. The subjects probe the risks as per specified method and list up the risks. The subjects record the risks on the cards. And this time they record 1 risk on 1 card. The work on Problem 1 and Problem 2 are finished each in 15 minutes, and the Problem 3 is finished in 30 minutes. The time difference of Problem 2 and Problem 3 was made to check that whether the time required for investigating varies or not for 3 methods of brainstorming, original KT-PPA, and improved KT-PPA.

STEP4:

The upper-class persons of risk management check the contents of the experiments. Fundamentally by dividing the investigated data in [risks], [risks irrelevant information] the correct data and wrong data are classified.

In the experiment, the information set up by operative measurement is acquired as experimental data.

5.2 Experimental results

[Example of correct and wrong data obtained in the experiment]

In the data obtained in the experiment, the chances are that besides correct risk data [correct data], there will be risk irrelevant data [wrong data] by selection mistakes. It is important to identify both the data, when summarizing the experimental data. In the experiment the examples of risks classified as correct data are shown in Figure 9. In the experiment the examples of risks classified as wrong data are shown in Figure 10.

- Since codes are checked visually a clerical error may be overlooked.
- During the reboot of a server, hardware failure may occur and the server may be unable to be started.
- Although the access rights problems were solved, other problems may occur and use of a file server may become impossible.

Fig. 9 Examples of identified risks.

- How much will be the quantity of the source code to check?
- It was confirmed that the Access Privileges of the server were not appropriate.
- Investigation results proved that there were no problems for setting.

Fig. 9 Examples of the irrelevant information for risks.

[About summarizing the data obtained in the experiment]

Now, in extraction work of risks, the data extracted by groups α , β , γ , δ , ε including the [wrong data] collected as α , β , γ , δ , ε respectively. If all the data selected by mistake [irrelevant risk data] are summarized as E , the corrected risk data selected by each group can be shown as below.

$$\text{Group } \alpha: \quad - E = \bigcap E^C$$

$$\text{Group } \beta: \quad - E = \bigcap E^C$$

$$\text{Group } \gamma: \quad - E = \bigcap E^C$$

$$\text{Group } \delta: \quad \delta - E = \delta \bigcap E^C$$

$$\text{Group } \varepsilon: \quad \varepsilon - E = \varepsilon \bigcap E^C$$

For experiments 1, 2 and 3, the results of the application of above expression are shown in Table 1, Table 2, and Table 3 each.

6 Evaluation of Experimental results

(1) Comparison from the number of extracted correct data.

By the number of risks (correct data) investigated as a result of analysis Group α win all the other groups. Though the experience in actual business of risk management is almost the same as Group β or δ , they were able to extract much more risks. Again though the experiences in actual business of risk management of Group α ran short rather than Group γ or ε , they were able to investigate more or almost the same risks. From this it was proved that even the persons with less risk management experience could investigate more risks with improved KT-PPA compared to original KT-PPA or brainstorming. Again it was confirmed that this fact do not change with 15 minutes of experiments 1 and 2 or with 30 minutes of experiment 3. Thereby, improved KT-PPA had the low dependence on time, and it was checked that it could effectively investigate the risks even also in the limited time.

(2) Evaluation Risks Identification Methods

By experiment, the following things could be checked with improved KT-PPA method.

- By using the improved KT-PPA, as a result of comparing the number of investigated risks, even the persons with little experience of risk management were able to investigate risks effectively rather than persons with deep knowledge of risk management using original KT-PPA or brainstorming.

7 Conclusion

In this paper, we proposed concretely the method of identifying risks by using the method improved KT-PPA for project of risks management. And with the experiment checked the validity and implement ability. In the experiment took the general-purpose methods of brainstorming currently used widely and the original KT-PPA method and the results of comparison with improved KT-PPA, confirm that improved KT-PPA is more efficient and correct compared with brainstorming and original KT-PPA. This showed that improved KT-PPA method was superior to original KT-PPA, and the improved KT-PPA method could serve as a supportive tool more powerful than brainstorming for general-purpose methods for risk identification.

Finally, we describe our future schedule. We are going to analyze the data obtained in the experiment by a precision ratio[19] and a recall ratio[19].

Moreover, we are going to re-consider the data and rewrite the contents about evaluation of an experimental result. The near future, we are going to describe the analyzed result as a paper.

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We obtain the acceptance of Kepner-Tregoe group Japanese branch, and are doing the academic activity.

Table 1 Result of Experiment 1

	Group α		Group β		Group γ		Group δ		Group ε	
Method	Improved KT-PPA		Original KT-PPA				Brainstorming			
Experience	Beginners		Beginners		Middle Class		Beginners		Middle Class	
Total number of subjects	5		5		5		5		5	
Selected Data (Included Errors)	α	71	β	64	γ	66	δ	95	ε	85
Correct Data	$-E$	71	$-E$	62	$-E$	65	$\delta-E$	59	$\varepsilon-E$	63

Table 2 Result of Experiment 2

	Group α		Group β		Group γ		Group δ		Group ε	
Method	Improved KT-PPA		Original KT-PPA				Brainstorming			
Experience	Beginners		Beginners		Middle Class		Beginners		Middle Class	
Total number of subjects	5		5		5		5		5	
Selected Data (Included Errors)	α	83	β	71	γ	76	δ	92	ε	80
Correct Data	$-E$	81	$-E$	70	$-E$	74	$\delta-E$	54	$\varepsilon-E$	71

Table 3 Result of Experiment 3

	Group α		Group β		Group γ		Group δ		Group ε	
Method	Improved KT-PPA		Original KT-PPA				Brainstorming			
Experience	Beginners		Beginners		Middle Class		Beginners		Middle Class	
Total number of subjects	5		5		5		5		5	
Selected Data (Included Errors)	α	142	β	130	γ	132	δ	148	ε	149
Correct Data	$-E$	140	$-E$	126	$-E$	129	$\delta-E$	107	$\varepsilon-E$	133

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