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AN APPRAISAL OF THE KNOWLEDGE WIZARD™ AND ITS POTENTIAL APPLICATION TO HUMAN RESOURCES

by

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and
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DECEMBER 2002

OTTAWA, CANADA

National Defence Défense nationale

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ABSTRACT

This research note documents an appraisal of a recently developed commercial software package, The Knowledge Wizard™, and its potential use to solve Human Resource problems. The paper provides a brief description of the software package, along with a case study that was used to evaluate the Knowledge Wizard methodology. Specifically, the case study involves the recurring problem of retention of military personnel in occupations that are in demand in both the military and the civilian world.

RÉSUMÉ

Cette note de recherche est le résultat d'un effort d'évaluation d'un logiciel récent, The Knowledge Wizard™, dans le contexte de son utilisation possible pour résoudre des problèmes spécifiques au domaine des ressources humaines. Le document offre une courte description du logiciel, suivie d'une étude de cas qui a été utilisée pour démontrer et évaluer la méthodologie du Knowledge Wizard™. Plus précisément, l'étude de cas porte sur le problème de rétention du personnel militaire dans des occupations qui sont en demande autant dans le monde militaire que dans le monde civil.

TABLE OF CONTENTS

AN APPRAISAL OF THE KNOWLEDGE WIZARD™ AND ITS POTENTIAL APPLICATION TO HUMAN RESOURCES

I. INTRODUCTION

1. The motivation of the work presented herein was two-fold. First, the authors were confronted with the problem of finding ways to keep trained military personnel from leaving the Forces in situations where their skills are in high demand in the civilian world and where the Forces cannot compete in terms of salary. Second, the authors were exposed to The Knowledge Wizard™ (KW) developed by Ideation International Inc. [1], and were interested in evaluating its usefulness when addressing Human Resource (HR) related problems.

2. The approach selected for testing this software was to use it on a real HR problem, the retention problem. The evaluation was done from two points of view. The authors evaluated, in a rather informal manner, the "technical" attributes of the software, such as its ease of use, and the level of decision support offered by the software in the various stages of the problem solving process. This was achieved through discussion on these "technical" topics and by keeping a diary of the work done. The evaluation of the results that were generated through the software was done in a more formal manner. They were submitted to several panels of "judges", through oral presentations, and were subsequently compared with retention packages approved in other countries.

3. This paper focuses on the appraisal of the software. Given its sensitive nature, the complete set of ideas generated is not included here. They will be published in a separate classified paper.

4. This document begins with a brief description of the software and a discussion of its potential benefits and limitations. This is followed with the case study and finally there is a section dedicated to lessons learned and concluding remarks.

II. THE KNOWLEDGE WIZARD SOFTWARE

5. The KW software is an implementation of the "Theory of Inventive Problem Solving". This theory emerged from a study performed over 50 years in Russia, by Genrich Altshuller and his students [2,3]. They studied approximately two million patented inventions and innovations and observed that for every truly new and great idea, there are a multitude of "variations on the same theme", all of which were granted patents. Based on this observation, they concluded that there must be a way to systematically enhance one's creativity up to the point where obtaining a patent is made possible. While leaving the great inventions to chance discoveries by the geniuses of this world, there is still the possibility for the rest of us to produce "small inventions", when properly assisted by a tool built for this purpose.

6. The KW is meant to be such a tool. This software package consists of a comprehensive database containing "best practices", plus a set of algorithms whose role is to extract information from this database by "pointing and clicking" instead of having to perform queries. The set of algorithms that is added on top of the database also helps to make the system interactive. In a nutshell, the result could be described at the macro-level as a "user-friendly database".

7. At the micro-level, the KW process could be described through the various steps in applying KW to a given problem:

a) Questionnaire. The first phase of the process is a questionnaire that is part of the KW software. It provides a structured framework that allows the user to document in the software the problem to be resolved. The questionnaire addresses issues such as the purpose of the project, the problems expected, the resources available, past solutions to the same problem (if any), etc. Thorough completion of this questionnaire leads to a detailed problem definition, which is a worthwhile step towards the successful resolution of any problem.

b) Diagram (Model). The second step is to build a diagram (or model) of the problem. The detailed problem definition obtained from answering the questionnaire is reviewed with the purpose of clearly identifying the main goals and the drivers of the problem. A diagram is then built, using pre-defined symbols in the software, to show the goals of the project together with the most important factors that have an impact (either positive or negative) on reaching these goals. The purpose of the diagram is to obtain a definition of the problem, simple enough for the software to work with, while still covering all the main drivers of the problem and the relationships between them. Note that, although it might be tempting to skip Phase 1 (Questionnaire) and start the process with this simplified model of the problem, it is important not to do so, to avoid over-simplifying the problem. It is crucial to begin the process with the problem as well defined as possible, including as many details as reasonable, and then work your way back towards the simplified model by "trimming" the original definition, cutting off the less important elements. Deciding what will go into the diagram and what will be left out is a very important decision and following the process suggested by the KW can help make this decision defendable. It also increases the confidence that the model eventually built is credible and valid.

c) Directions for Innovation. The software will provide the user with a number of "directions for innovation", which are derived directly from the model. The software isolates elements of the diagram, based on the relationships between them, and creates directions for further study, or sub-problems on which the user should focus. The result of this phase is that the original problem is divided into a number of significant sub-problems. The underlying idea being a "divide and conquer" strategy. If the number of directions for innovation generated by the software is high, a prioritization of these directions is suggested. Although some guidance is offered regarding the rules for the prioritization, this prioritization is ultimately up to the user and may depend heavily on the time available for the project. If there is not enough time to cover all of them, only a subset of directions (the ones showing more promise toward solving the problem) will be

selected for further consideration. Each of the selected directions for innovation should be examined by the user with assistance from the software.

d) Examples from Other Fields. The type of assistance that is offered by the software takes the shape of appropriate examples from other fields. The user can then use analogy to generate ideas for his/her own problem (or sub-problem, to be more precise), based on these examples. At the end of this phase, the user has a set of ideas that have potential to solve or improve one particular aspect of the original problem. These ideas are referred to as "preliminary ideas".

e) Combine Ideas into Concepts. The purpose of this step is to make the set of preliminary ideas, which could be large, more manageable. Ideas are grouped in categories or concepts, based on the existing relationships between the ideas. An additional goal of this step is to remove any redundancy in the list of ideas.

f) Evaluate Results. The previous step can be seen as one way to make the ideas easier to evaluate, by evaluating the concepts rather than the individual ideas. Concepts are evaluated in order to select one or more of them for implementation. As such, the evaluation process covers issues such as strengths and weaknesses of the concept, potential secondary problems that might appear should the concept be implemented, etc. Costs, risks, benefits and all other relevant factors should be considered as potential criteria to evaluate the concepts. Note that, although the KW provides some guidance for evaluating the results, the responsibility for this step is placed largely on the shoulders of the user.

g) Plan Implementation. Similarly, the KW provides some guidance on producing an implementation plan for those concepts that "passed" the evaluation phase. However, this guidance is limited to a checklist of things that any good implementation plan should cover, which is useful, but, once again, the responsibility for this stage of the problem solving process is placed on the user's shoulders.

III. ROLE OF THE KNOWLEDGE WIZARD IN THE PROBLEM SOLVING PROCESS

8. Figure 1 illustrates the authors' view on how the KW fits into a generic problem solving process. The various stages in this process were identified as: problem definition, problem analysis, development of options, option analysis (Benefits/Costs/Risks Analysis) and recommendations (including the implementation plan).

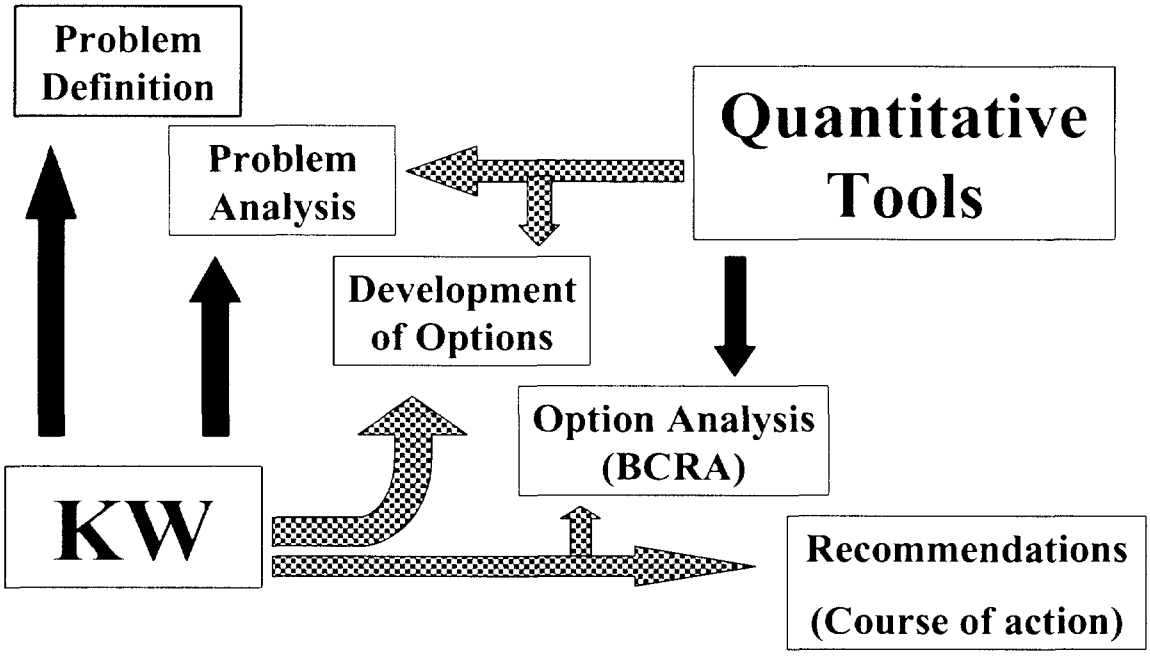

Figure 1. Fitting the Knowledge Wizard into the Problem Solving Process

9. It is the authors' opinion, based on their experience with the KW, that although this software can be instrumental in the stages of problem definition, problem analysis and the development of options, it can only assist to a limited degree in the next stages of the problem solving process. Moreover, unless the problem to be solved is particularly simple or very qualitative in nature, the KW should be complemented with some quantitative tools, especially in the 'options analysis' stage. The solid red arrows in Figure 1 are used to illustrate a potential *major impact*, while the checkered arrows illustrate a *limited impact* that either the KW or what we generically call "Quantitative Tools" may have in the various stages of the problem resolution process.

IV. CASE STUDY: THE RETENTION PROBLEM

10. The authors used the framework provided by the KW to address the problem of improving retention rates in a generic military occupation in which its members possess skills that are in significant demand in the civilian world.

11. During the phases of problem definition and problem analysis, the KW was the only tool utilized. The diagram (model) produced and used as the simplified version of the problem is shown in Figure 2.

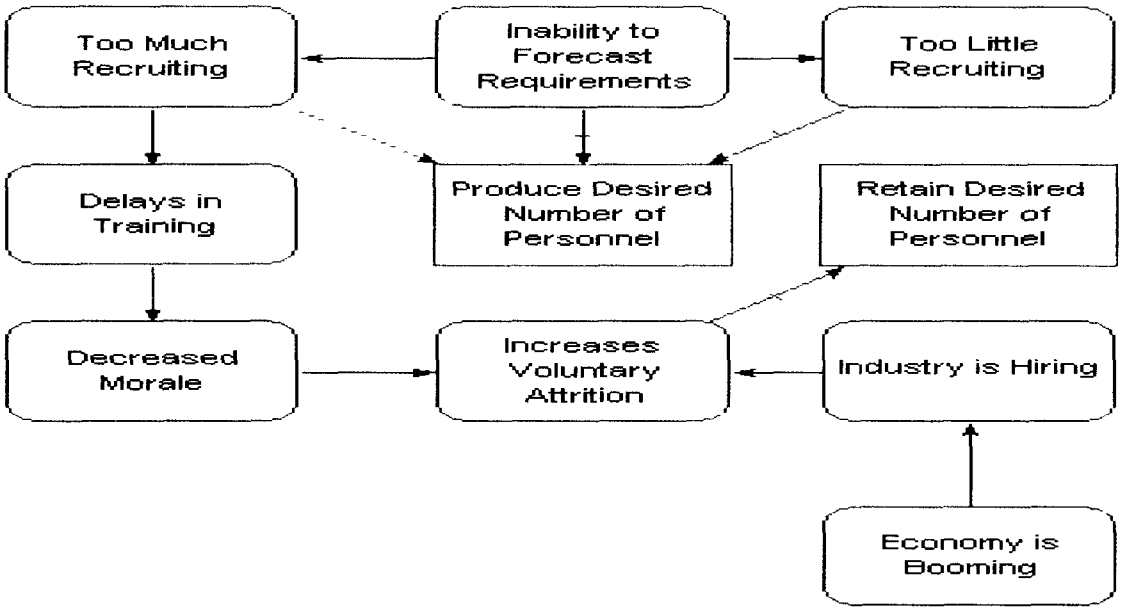

Figure 2. Representation of the Problem Using a Diagram Built in the Knowledge Wizard

12. The model depicted in Figure 2 is shown as it would be seen in the Knowledge Wizard software. In this figure, the two objectives of producing and retaining the desired number of personnel are represented in the two green boxes (square cornered boxes). The red (rounded) boxes represent various other factors that were considered to have a significant direct or indirect impact on the two objectives. An arrow between two boxes indicates a direct cause and effect relationship between the events in the boxes. A

green arrow illustrates a positive effect, while a crossed arrow signifies a negative impact.

13. After building the diagram in Fig.2, the software generated 15 "Directions for Innovation". Two of them did not make sense[1] and were not explored. The 13 remaining directions were tackled one by one, and, based on the numerous examples from other fields that were provided by the software, the authors generated 303 raw ideas (also called "preliminary ideas") over 16 two-hour sessions.

14. An example of one idea among those generated using the KW is the following. **Based on the Direction for Innovation**: *Find an alternative way to produce the desired number of personnel that does not require too much recruiting and is not influenced by the inability to forecast requirements or too little recruiting.* **The KW software suggested:** *To ensure an organization's growth, create a positive (reinforcing) feedback loop. In a positive feedback loop, every step in the organization's evolution increases its value in the eyes of society and its members (or increases its market value), which stimulates further growth, and so on.* **The KW software provided the specific example:** *"Pyramid" schemes (illegal in many countries) are revenue systems that require an endless stream of recruits for success. Recruits (a) give money to recruiters and (b) enlist fresh recruits to create a bottom-up revenue source. The result is almost always inevitable: at best, the top-most members walk away with a lot of money, while most recruits lose their investments.* **The idea generated by the analysts was:** *Use the military training process to track the personnel that have gone through it according to who was their mentor/instructor and compensate/reward these mentors/instructors later in their career and maybe even after their retirement for the accomplishments of their students. In this way, we build a positive feedback loop in which successful career*

[1] Because the *directions for innovation* are generated automatically by the software, it may happen that some of them do not make sense. For example, in our case study one such direction was: "Find a way to eliminate, reduce or prevent the booming of economy, in order to avoid an increased demand for pilots from the part of commercial airlines." Of course, one could not seriously consider the voluntary slowing down of the economy as an option to solve one's problems However, these false directions can hardly be considered a drawback of the software, because all the user has to do in such cases is to ignore them.

military personnel inspire young military personnel to become successful career military personnel.

15. The 303 ideas were evaluated independently by the two analysts using a scale of 1 to 4. The highest rating ('4') was awarded if the idea was considered a "Go" (i.e., the idea is definitely worth considering for implementation). The lowest rating ('1') was attributed to ideas that were considered "NoGo" (better to be abandoned). A rating of '2' indicates a "Maybe NoGo" idea, while a rating of '3' indicates a "Maybe Go" idea. The results of these ratings (shown in Table I) were used to perform a first screening of the ideas. Only those ideas rated "Go" by both analysts or rated "Go" by one analyst and "Maybe Go" by the other (the figures in bold font in Table I), were kept for further analysis, while the rest of the ideas were screened out.

TABLE I
FIRST SCREENING OF THE IDEAS

	NoGo	**Maybe NoGo**	**Maybe Go**	**Go**
Go	1	2	**12**	**43**
Maybe Go	8	16	30	**93**
Maybe NoGo	5	15	18	30
NoGo	5	12	5	8

16. The 148 (12+43+93) ideas kept for further analysis were classified by their potential to lead to benefits in the short, medium or long term and then by the specific categories of solution they represent, in the spectrum of potential solutions to the retention problem. The result of this grouping is shown in Table II.

17. A 'concept' could then be formed (in this case) by the ideas included in the intersection between one of the classification on the left in Table II and one of those at the top in the same table. For example, the eight ideas included in Quality of Life / Short Term Benefits (the two grey cells in Table II) could be evaluated to form a concept.

18. After grouping the ideas into concepts, the KW suggests that the concepts should be evaluated using some appropriate criteria. However, the authors did not feel

comfortable with grouping ideas into concepts, because they did not find it obvious that if a concept "passed" the evaluation tests, that necessarily meant that all ideas included in that concept are good ideas that should be part of the recommendation package. Instead, the authors felt that a "cocktail" or mix of ideas (not necessarily inter-related) might be preferred to the use of concepts (which, by definition, are composed of inter-related ideas).

TABLE II

GROUPING SCREENED IDEAS INTO CONCEPTS

	Short Term		Medium Term		Long Term		Unrated	
	Go-Go	Go-Maybe	Go-Go	Go-Maybe	Go-Go	Go-Maybe	Go-Go	Go-Maybe
Quality of Life	2	6	7	8	2	5	0	0
Training	2	10	0	9	0	5	0	1
Analysis	3	2	3	11	0	0	0	6
Motivation	3	2	4	5	4	6	0	0
Recruiting	0	2	1	4	0	4	0	1
Marketing	1	2	0	4	2	0	0	0
Contractual	1	2	0	1	0	0	1	0
Operations	3	1	0	1	0	0	0	0
Promotions	1	0	0	1	2	0	0	0
Technology	0	1	0	0	0	1	0	1
Reserves	0	1	0	0	0	1	0	0
CF Structure	0	0	0	1	0	0	0	0
Anti-Industry	0	1	0	0	0	0	0	0

19. An evaluation of each idea was completed taking into account the potential risks and potential benefits, against the estimated costs using a rough order of magnitude scale of "(1) = low", "(2) = medium" and "(3) = high". This process identified the ideas that showed the most potential and, as such, constitute good candidates for inclusion in the package of recommendations. We divided the benefit score by the risk score and then this benefit to risk ratio was divided by the cost score to determine the value per dollar. The ideas were then prioritized by sorting them according to increasing value per dollar. In Figure 3, each point on the curve represents a package of ideas. The curve is produced

by finding the next point through the addition of one more idea to the previous package. Thus, incrementing the value and the cost of the package.

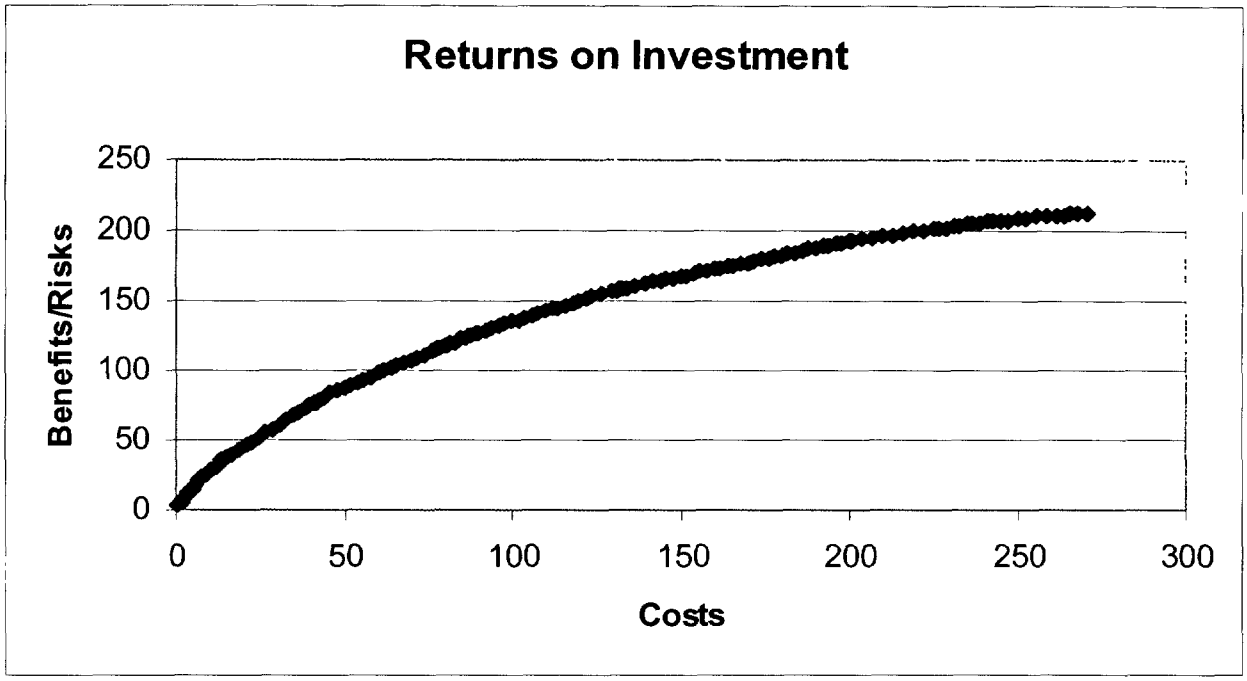

Figure 3. Maximum Benefits and Minimum Risks for a Given Budget

V. LESSONS LEARNED AND CONCLUDING REMARKS

20. Some of the lessons learned after our experience in working with the KW include the following (in no particular order):

a) Give the process the time and the resources it requires. In our study, we had two analysts working for 16 sessions of a maximum of two hours each.

b) Preferred size of a team should be two persons. Having two people "bounce" ideas off each other is an excellent method of enhancing creativity. While teams of three people are acceptable, teams of four or higher are not recommended because the software is a standalone application and there would be a great deal of downtime for the other members as one member's idea is being input into the system. This would cause them to lose their enthusiasm for the process.

c) The preferred team would be one Analyst and one Subject Matter Expert (SME). The software may be user-friendly enough to have two SME's work together. In our study, we had two analysts working together. This was probably not optimal.

d) Preferred work session duration should be around 2 hours. The creative process can be quite strenuous. It is often better to take a break rather than push one's self to the limit of one's energy.

e) To maximize the impact, one should get involved in the early stages of the project. Our work with this military trade came into the process too late to have significant influence on the final recommendations. However, our generic results may be useful for other trades.

f) We feel that the KW software could be used in a workshop format to enhance creativity in larger groups. For particularly difficult problems, several teams could tackle individual 'directions for innovation' separately and come together to compare results. Time permitting, one could allow a certain amount of overlap between the directions assigned to each of the teams.

g) Include quantitative analysis with the KW. Prioritization and Benefits / Costs / Risks analysis can be highly beneficial in the evaluation and recommendation development process.

h) Capture together the 'direction for innovation' => 'suggested approach' => 'example' => 'idea generated'. This will be useful when building a case to support the recommendations by showing the specific part of the problem that is being addressed, how it is being addressed and a well-known example of how a similar problem has been solved using this approach.

i) Go through the entire process (adapted for your own needs if necessary), complete with quantitative analysis, before making formal presentations to the decision makers.

21. To conclude this paper, there are two important questions that still need to be answered. The first one is: "Was the retention problem in this trade solved using the KW?" The short answer would be "No". The long answer would be "No, but significant progress was made". The authors unfortunately came into the process too late to have a

significant influence over the recommendations package. However, it is felt that many of the ideas generated could be easily transferred to other trades in the Canadian Forces. We hope that, once published, the collection of retention ideas generated during this software evaluation exercise will be useful for future studies.

22. The second question that is anticipated from every reader is: "Would we use the KW software again?" Our answer is "Yes". We found it very helpful in the problem definition stage of the work. Also, the creativity enhancement aspect of the software pushed us 'outside the box' and kept us working through the various directions and suggestions until we were convinced we had given the problem significant coverage. As a final test, the set of solutions generated through the Knowledge Wizard was compared to the retention packages approved in three other countries (US, UK, Australia) and it was found that all but one of the retention measures implemented in the three countries were also identified using this software.

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