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Dynamic expert system for intellectual property management

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Abstract
A dynamic Expert System (DES) for Intellectual Property (IP) Management in Corporate bodies has been designed and implemented using Electronic Development Institute (ELDI) Awka, Anambra, Nigeria as case study. This is a system that will capture the present best practice for every shade of work done in a company which is what represents a company on paper, if a staff of the company resigns, dies or goes away and a new personnel is hired and trained with those best practices, they will represent the company well because the best practices represent all that is done in a company in the best possible way. A dynamic expert system (DES) is dynamically kept up to date as more knowledge is gained. This is a useful means of managing the Intellectual Property that drives an organization forward so that the Knowledge Repository can be enhanced with new industry best practices as more knowledge is gained and edited to remove obsolete knowledge. A quarterly elicitation process is done in a continuous in-house search for new IPs. The new IP claims are validated through peer review and successful ones are used to update the DES knowledge Repository. This makes the operational IP of the corporate body grow dynamically with industry best practices. The software used for the Dynamic Expert System (DES) inference Engine is written in Java Programming Language. DES was validated by comparism with other related projects and it was found that Des performed better than others in five (5) of the ten (10) areas of comparism used.

Keywords: dynamic, expert, system, intellectual, property, management

1. Introduction
Intellectual property is an important measure of corporate value. The ability of firms to support the application of new knowledge depends increasingly on effective management of intellectual property (IP). An expert system or Knowledge Repository System results when the knowledge of a Domain Expert is elicited and stored in a knowledge repository and an Inference Engine (software) is developed to sift through the knowledge repository in a manner that mimics the Domain Expert's thinking process when a problem requiring the Domain Experts knowledge occurs, James A. (2008) [4]. This enables the expert System to arrive at a solution to the problem comparable to that of the Domain Expert. An expert system development necessarily focuses on a narrow domain of human endeavor for which there is a domain expert. It is also possible to distill the knowledge of a number of Experts in the same domain into one and the same expert system when each of such experts can be reached and made to work co-operatively in order to establish the Expert System. The advent of the internet has made possible the collaboration of many experts in the same domain in widely dispersed geographic locations, Chris *et al*. (2008) [1]. To develop a knowledge repository requires the services of a well trained Knowledge Engineer whose job is to elicit knowledge from relevant Domain Experts, codify the Knowledge and store same in a computer-based repository or knowledge repository which will then be used by the Inference Engine when searching for expert-like solutions to problems. The Knowledge Engineer elicits tacit knowledge from Domain Experts who helps him to transform knowledge from tacit to explicit knowledge through mutual interaction, Simon Kendal (2007) [5]. To encourage a Domain Expert to release his expert knowledge in whatever form is a task that requires great tact and a careful approach by the knowledge Engineer in order to reach the accurate knowledge in the brain of the Domain Expert. Often, such Knowledge is in the form of heuristics or educated shortcuts used by the Domain Expert when solving problems. These must be properly understood and codified by the Knowledge Engineer during Knowledge repository System development. An Expert System is static when there is no means of improving its expertise once it is developed, Suzanne S. (1999) [6]. It can only mimic the intelligence found in Domain Expert(s) at the point of its development even if the situation has changed. Dynamic expert system is dynamically kept up to date as more knowledge is gained. This is a useful means of managing intellectual property that drives an organization forward so that it can be enhanced as knowledge increases and edited to eliminate obsolete knowledge or techniques. The dynamic expert system is thus able to keep track of best practices at any point in time and grows like a living organism to enhance organizational performance as it grows richer with best practice.

2. Aim and Objective
This research is aimed at modeling a dynamic expert system for Intellectual Property management in corporate bodies.
The objectives, in pursuance of this aim are:
1. To model an expert system for the automation of Intellectual Property of an organization.
2. To use knowledge elicitation techniques continuously to identify best practices to be used to dynamically optimize the decision rule of the expert system.
3. To model the decision structure of an organization in terms of a hierarchy of corporate expert system, each representing the automated best practices for handling corporate process at each level.
4. To carry out simulated evaluation of the proposed Dynamic

Expert System model for IP management using Cost based Approach.

3. Significance

1. The proposed system will enable corporate firms to effectively pursue the quest for business intelligence through stronger intellectual property capacity building.
2. It provides data management functionality and data evaluation to enable and streamline the firms' efforts in knowledge sharing and IP growth evaluation.
3. The proposed system should help to identify areas of improvement in terms of intellectual know-how and operational capacity.
4. The proposed model also supports speedy resolution of IP disputes.
5. A company may try to have an edge over its competitors by researching into better ways of carrying out their operations. The outcome of such research would no doubt make a new set of best practices and intellectual properties available to the company. These would amount to quantum leap in operational capacity for the company whenever such research efforts yield positive dividends.

4. Review of Related Literature

Intellectual property (IP) rights are the legally recognized exclusive rights to a creation of the mind, Richard P, (2008). Under intellectual property law, owners are granted certain exclusive rights to a variety of intangible assets such as musical, literary and artistic works, discoveries and inventions; and words, phrases, symbols and designs. Common types of intellectual property right include copyright, trademark, patents, industrial design, trade dress and in some jurisdiction trade secrets.

Although it is acknowledged by historians that many of the legal principles governing intellectual property rights have evolved over centuries, it was not until the 19th century that the term intellectual property began to be used , and not until the late 20th century that it became commonplace in most of the world Mark A. (2005). It is reported, Brad. S (1999) that the British statute of Anne (1710) and the statue of Monopolies (1624) are now seen as the origins of copyright and patent law respectively. It is strongly argued in referenced literature Sullivan P.H (2003) that there are substantial advantages in locating IP management functions within the organizational management structure. The argument advanced is that the organizational level structure has direct impact on the performance of the IP management processes. However the position of a number of authors Mylopoulos J. (2006), Yu .E. (2000), Rivette K.G. (2003) is that to analyze the strategic significance of particular pieces of knowledge or intellectual property within an organizational and business context, an ontology that captures the social and intentional dimensions of IP management is needed. Along this line of reasoning, Yu .E. (2000) proposed a strategic actor relationship modeling framework to support IP management. In strategic actor relation, actors have goals, and know-how and resources for achieving goals. Patents restrict the use of know-how, thus prompting actors to reposition themselves within a network of dependency relationship. This approach centered on strategic actor relationships which have been used for modeling and analyzing IP management issues, Yu .E. (2000) claimed that, this ontology made it possible to go beyond entity relationship and mechanistic behavior, to deal with the opportunistic behavior of strategic actors. Interdependencies among actors place constraints on their freedom of actions. Nevertheless, constraints can be violated due to agent autonomy (unlike in mechanistic system) as in the patent infringement case. Strategic actors seek to achieve goals by exploring and evaluating alternatives, taking into account the opportunities and vulnerabilities arising from various dependency relationships. Sullivan P.H. (2005)] emphasize systematic IP management processes and analysis particularly the quantification of economic value of intangible assets and intellectual property. There is also increasing use of computational techniques, e.g. patent database search and retrieval and cluster analysis to determine distribution of patent among subject areas, Rivette. K.G (2003).

5. Methodology

The expert systems development methodology was used in this research. This methodology requires that a Domain Expert (someone knowledgeable in the domain of interest) be found. His knowledge is elicited by the knowledge Engineer, codified, and stored in the knowledge base. Then an inference engine is developed that will sift through the knowledge base, when a new problem arises, mimicking the thinking process of the expert to come up with expert-like solutions to the new problem.

In this research, the intellectual property (IP) of the workforce constitute the source of knowledge that will be stored into the knowledge repository. The Researcher is the knowledge engineer, the workforce in the various productive activities of the company constitute the domain experts, each in his or her own activity group. The Knowledge Engineer interviews the workforce, searching for best practices in each operation done in the group of activities he or she belongs to. The direct supervisor of each worker together with the overall operations manager help the Knowledge Engineer to evaluate and ratify the knowledge elicited from the members of the workforce. The Knowledge Engineer codifies the elicited knowledge after transforming each from implicit to explicit knowledge. The codified explicit knowledge is then stored in the knowledge repository. The Knowledge Engineer uses the structured interview to extract IP from Staff.

The IP stored in the knowledge repository represents the best practices used in the company for everything they do. The best practices are made accessible to the entire workforces who have access to that portion of the knowledge repository accessible to them, every worker is expected to use only the best practice for every job he or she does. It is the responsibility of the direct supervisor or foreman to ensure that only the best practices are used by the workforce under him or her. To earn normal increment each year, a worker must satisfy the direct supervisor or foreman that only the best practices is used by him or her in all activities done in the company. Those workers found to possess IP best practices that would be to the advantage of the company if it is used to replace the existing one score promotional points and are further duly remunerated.

Knowledge elicitation is done quarterly from the workforce and the IP of the company grows like a living organism as old practices are replaced by new best practices. The company's bottom line improves because the customers are happy being served effectively and efficiently; the workers are happy because hard work is duly and promptly rewarded. Also the

workforce appreciates in value and the company is always compliant with the current ways of meeting their customers' needs. If any worker dies or retires or goes away in search of greener pasture or is sacked or suspended, someone easily takes over his or her job functions. The fact that the IP of the staff that is leaving must have been captured previously makes it easy for someone to be trained up quickly on best practices using the dynamic expert system. This minimizes losses due to the loss of services of any individual staff.

6. Analysis of the Existing System

The key features of the existing system (Fig 1) are as follows:

1. There is no effort to capture the IP of each worker.
2. The notion of industry best practice is not used in the company. Each member of the workforce works with his or her own preferred style whether it is efficient or not.
3. The direct supervisors or foremen are satisfied that the job is done and do not bother how efficient it was done or what level of customer satisfaction was achieved in the process.
4. If a worker leaves the company for any reason or is incapacitated, it may often be difficult to find a matching talent to replace his job functions exactly. An incompetent hand may take over and cause customer disaffection. This affects the company's bottom-line as disappointed customers stop patronizing them.
5. Many abandoned projects may exist as the company may not be innovative enough to follow things through.
6. The company gradually becomes obsolete and unable to find its feet in the industry to which it belongs.
7. As the return on investment dwindles, the owners of the company disinvest and the company eventually becomes moribund.

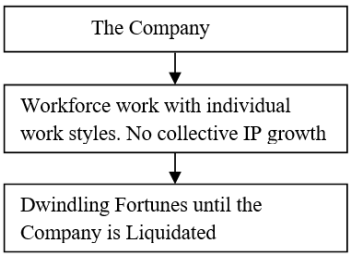

Fig 1: How the Existing System Works

7. Analysis of the New System (Fig 2)

1. The best practices for doing the company's work are captured from the company's workers quarterly through company-wide knowledge elicitation.
2. Each worker must use the best practices to serve the company or else he or she would not qualify for normal increment.
3. The direct Supervisor or foreman of each worker insists that the worker should use only best practices.
4. Best practices are updated on a quarterly basis and made readily accessible to the workforce.
5. If a staff leaves for whatever reasons, the IP of that staff is already captured and stored in the company's Knowledge repository. Someone can easily be trained to replace the staff that left.
6. The IP Knowledge repository is enhanced every quarter so that the company's workforce are continuously up to date with best practices.
7. The company may be blessed with Patentable projects which further enhances the IP knowledge repository of the company.
8. The company is able to keep its head far above water in these days of stiff competition because of good customer satisfaction arising from its use of best practices.
9. The company grows as old practices are abandoned and new ones followed in line with current trends.
10. The quarterly enhancement of the company's IP Knowledge repository makes the Expert System Dynamic and continuously relevant to current customer demands.

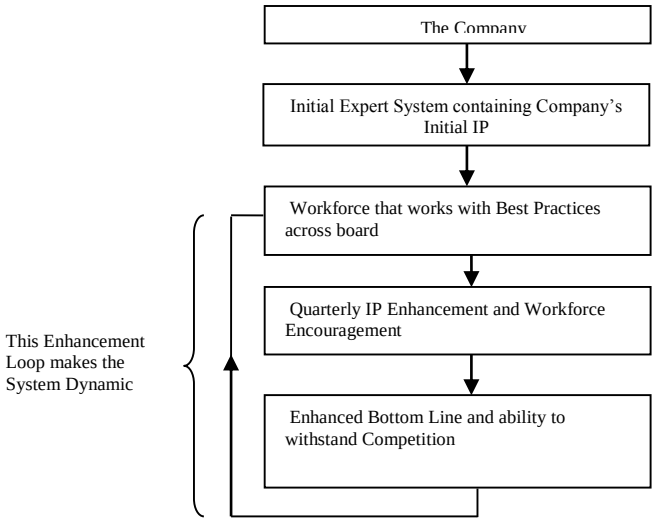

Fig 2: How the Proposed System Works

8. Modeling the Dynamic Expert System for IP Management

Intellectual property is knowledge in the brain of a company's workforce. Its management is capturing the best practices for each job function and making each worker use only best practices in performing each job function. The IP KR of the dynamic expert system therefore contains the knowledge inside the workforce that can make the organization move faster, smoother and better, and on the bottom-line, have higher income and better integrity. The dynamic expert system is meant to improve the IP content of the workers so that they work with greater effectiveness measured in terms of the following: efficiency of operation, reduced cost of job function, reduced time spent on a job function, customer satisfaction from the service rendered, Cost benefit analysis of the newly introduced best practices to ensure the company's bottom line is improved.

If any staff has an IP, the above is used to judge it. Using cost benefit analysis, if the cost of the IP is more than its benefit, such IP is dropped, and therefore not recognized as a new Best Practice.

If new jobs are added to a category of workers, the jobs' best practices are noted. The idea is that, the dynamic expert system contains the full best practices that are used in that company at any point in time. As things change, the older knowledge are weeded out as new best practices are introduced. So the IP of the company is growing dynamically with time. After several years, if a back log of all that were done previously is compared with the new practice, it will be found that there is growth. That way, the organization won't be obsolete for want of

improvement. By doing these, the capacity of the company will not be lost.

Fig 3 is the dynamic expert system model. The existing business practice of the organization at all levels are codified by the knowledge engineer and verified by the foremen/supervisor and the operations manager, and stored in the knowledge repository, this forms the initial intellectual property knowledge repository. A structured interview and elicitation technique that provides all the relevant knowledge in the minimum amount of time is used to capture the new intellectual property in the mind and head of the workforce. This is further validated and verified by the workforce foremen and operations manager before storing it in the knowledge repository. On the other hand, if there is an available R&D effort, knowledge is elicited by the knowledge engineer, verified and validated with the help of the foremen, operations manager together with the knowledge engineer. The new best practice is codified by the knowledge engineer, and is used to update the existing knowledge in the repository, Business strategies are aligned to match new IP findings. New IP are made available to the workforce. The knowledge repository is further enhanced by patenting and project costing evaluation. There is a monitoring of new IP usage by the project team and project supervisors. Staff who contributed are remunerated. Continuous monitoring and elicitation of knowledge from the workforce makes the system dynamic.

A dynamic Knowledge base is a stream of knowledge repository of N records

$$KR_{size} = N \text{ records} \quad (1)$$

When a knowledge is removed for enhancement, it becomes

$$KR_{del} = KR_{size} - 1 = N - 1 \quad (2)$$

In Eqn (3), an absolete knowledge is removed, therefore the knowledge repository size becomes N – 1. If the removed IP is replaced by a better one, at that point, the knowledge repository becomes N. So the overall number of IP in the knowledge repository remains the same.

$$KR_{add} = (KR_{size} - 1) + 1 = KR_{size} = N \quad (3)$$

The enhancement of IP does not change the size of knowledge repository. It removes what was there and adds a new IP. After each research effort, a knowledge elicitation is done to search if new IPs have been found; the addition of new IP found for existing work processes followed the equations shown in equations 1 - 3. However if a new process is started then new IPs are developed to match the demands of the new process. Unlike the IPs used to replace the obsolete ones leaving the number of IPs in the knowledge repository the same, new IPs arising from a new process increase the number of IPs in the knowledge repository, thus knowledge repository grows in terms of number of IPs represented in it, This is shown in equation 4. If the number of entries in the knowledge repository N and M is the new IP meant to support a new process developed by the research team, then the size of knowledge repository becomes;

$$\text{New Process } IP_{(size)} = M_{new}$$
$$KR_{(size)} = N + M_{new} \quad (4)$$

There is a constant monitoring of new Intellectual Property. The staff are motivated to contribute by remunerating those who contributed their knowledge and also those that used the newly found best practice (Fig 3). After the Elicitation process, the Knowledge is converted from implicit to explicit, this is known as Externalization. When tacit knowledge is made explicit, it is codified into documents, manuals, etc, knowledge is crystallized, thus allowing it to be shared by others, and it becomes the basis of new knowledge. On the other hand, if there is R&D funds, the company will pursue R&D and go for patent rights. Also it will align its business strategies and disseminate it to the affected levels in the organization. It is envisaged that by using the scheme shown in fig 3 for the dynamic expert system, professional efficiency and improved operational effectiveness is achieved. It is an enhanced way of doing things, a way of enhancing the quality of service rendered to customers, in a speedier way. It enhances IP content of the workforce or their know how. It makes them be operationally more efficient and they render a faster service than their competitors. This enables them maintain their customer base or improve on it, and makes the organization to have an edge over its competitors.

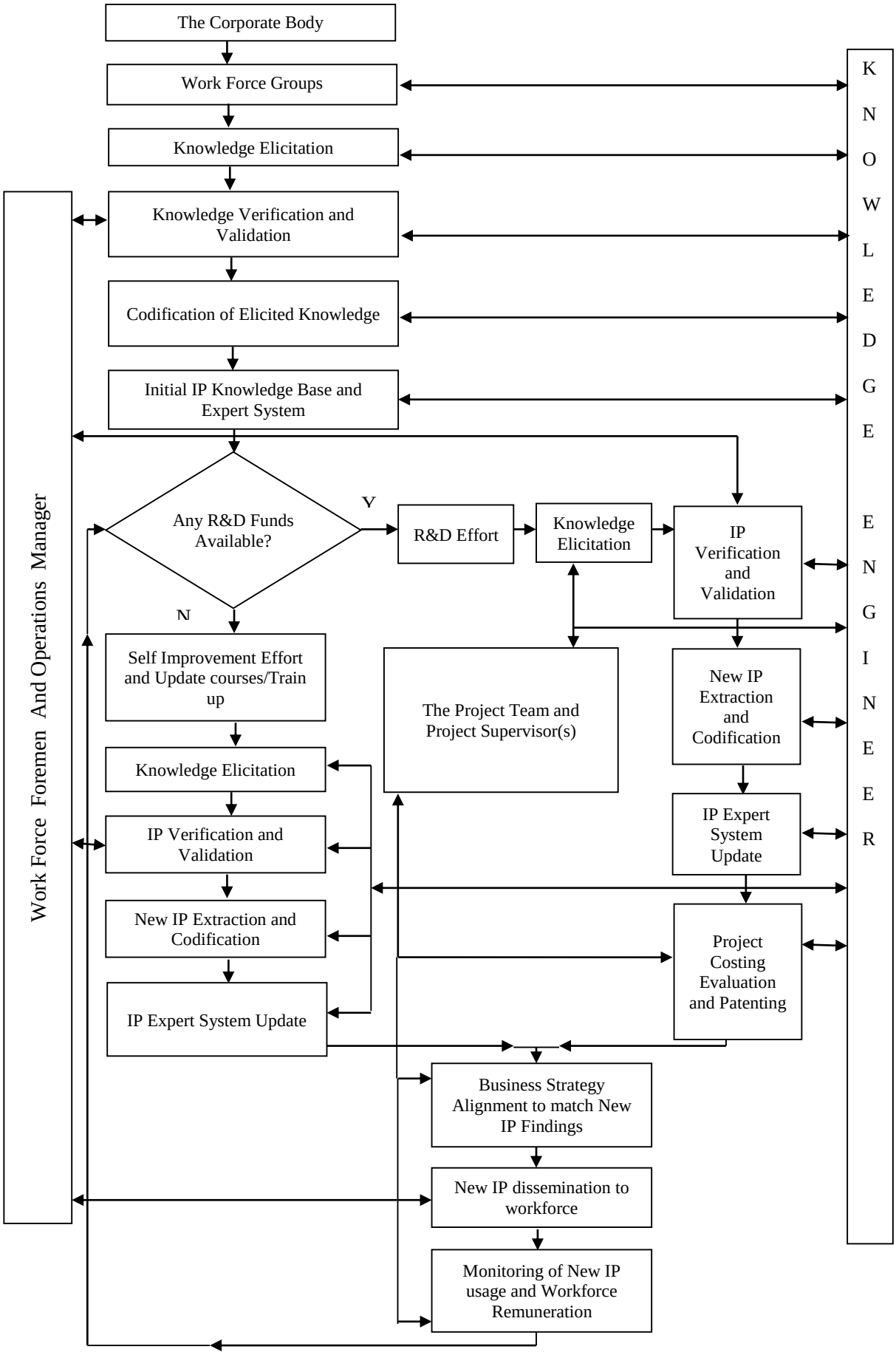

Fig 3: The Proposed Dynamic Expert System Model

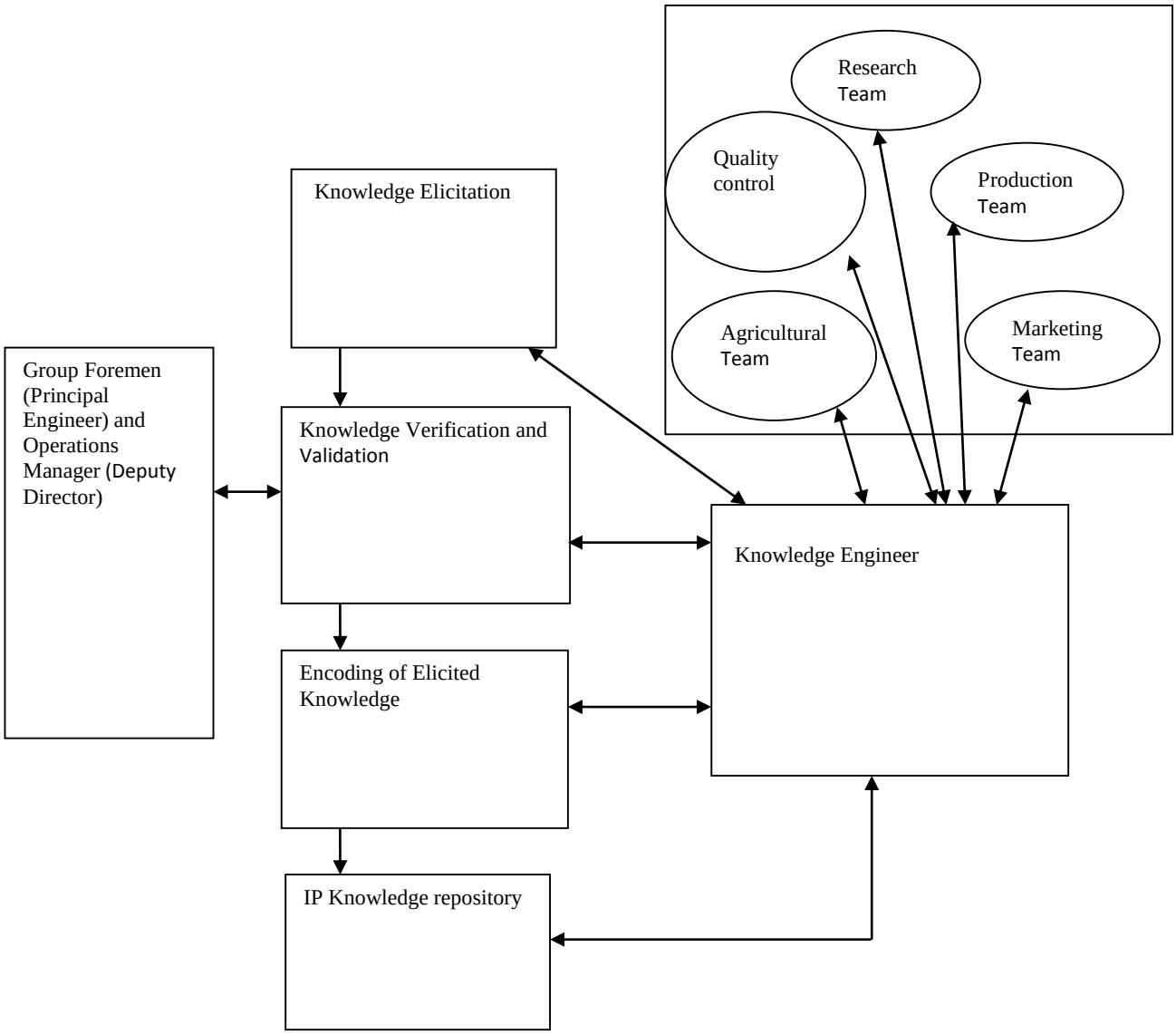

Fig 4: Knowledge Engineers roles in Interactive Knowledge Elicitation

The basic model of knowledge engineering portrays teamwork in which a knowledge engineer mediates between the expert and the knowledge repository. Fig 4 shows the following task performed by the knowledge engineers at different stages of knowledge elicitation.

9. Case Study

The Company used as case study is Electronic Development Institute (ELDI) Awka, Anambra State, Nigeria. The Group of workers participating to create a Dynamic IP expert system are:

i) Research Team
ii) Production Team
iii) Quality control Team
iv) Marketing Team
v) Agricultural Team

IP knowledge is elicited from each group in turn and added to the IP expert system comprised essentially of best practices for each category of workers above. The best practice for each identifiable job function of each category of workers is elicited, codified and recorded in the IP knowledge repository. The elicitation panel for each category of workers is comprised of the 1) Knowledge Engineer (Researcher), the foreman for that group of workers and the Operations Manager that is over and above every worker in all categories. These co-operated to validate IP content of the workers they lead. While the knowledge Engineer guided all in the process of knowledge elicitation, the foremen listen as each worker under them was interviewed by the knowledge Engineer and help to attest to the veracity of the answers provided by the workers. Typical interview questions are shown in section 12.0. The Operations Manager was also handy to further validate the views of the foremen as the knowledge elicitation process progressed. The outcome of the knowledge elicitation process is the capture and storage of the best work practices used in the company (ELDI) at all levels. These now constituted the primary IP knowledge repository which will begin to grow as the knowledge elicitation process is repeated in subsequent quarters of the year. A new best practice may be found which then leads to the deletion of the old practice from the IP knowledge repository and the inclusion of the new best practice in the upgraded IP knowledge repository. A copy of the former IP KR is kept to facilitate a study on how IP grows in the company from quarter to quarter.

10 The Organizational Structure

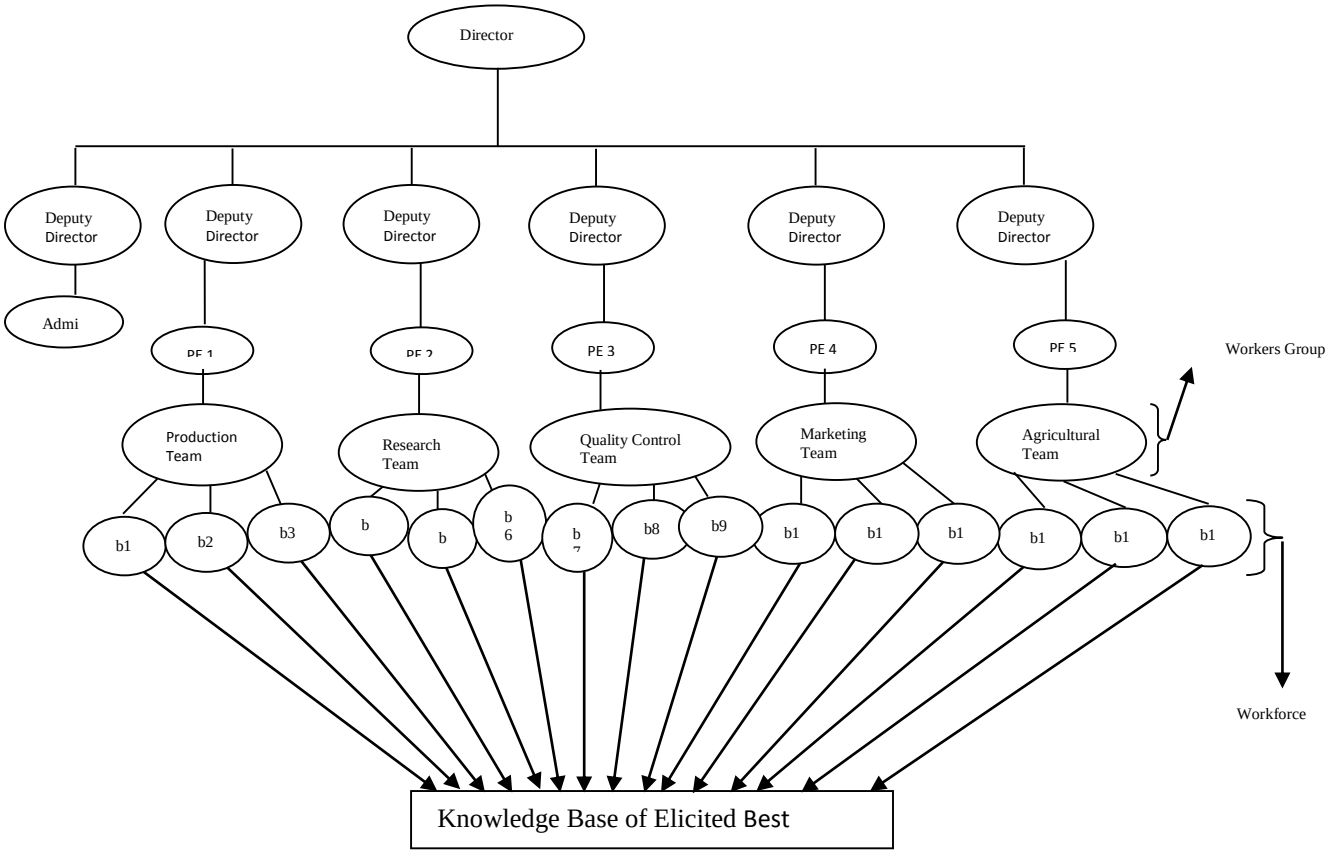

Fig 4: Model of IP management level structure.

PE = Principal Engineer

The leaf node of the level tree (figure 4) represents the staff in that level (b1, b2, b3…..bn).

This is the modeling of the level structure of the organization as it relates to IP management. This provides the framework for examining management decision, making performance in quantifiable terms. Hence the diagram (Fig 4) of the decision structure shows the Research Team, Production Team, Quality Control Team, Marketing Team and the Agricultural Team etc. Each Cadre has a foreman/controller (Principal Engineer) that reports to the Operations Manager (Deputy Director), who reports to the Director. All these work hand in hand with the Knowledge Engineer after which the output enters into the knowledge repository.

11. Sample Knowledge Elicitation Questions

The following are the questions that may be asked to an expert of a company in order to elicit Intellectual Property from him/her.

1. What is your name?
2. What is your Staff id?
3. In which section do you work in this company?
4. Can you give the detail of work done in this section one by one?
5. Of all these jobs, is there any one you think can be improved upon compared to the style you are using now?
6. Which one if any?
7. What methods do you use to do this work?
8. What is the new method you are recommending?
9. Is there any other improvements that can be done anywhere in the section?
10. Is there any other section you would like to be deployed in, in this company?
11. Which section if any?
12. State your reasons for wanting to be there?
13. Would you like to ask us any question?

Table 1: Table Structure for Captured Expert Information

						Quality of IP				
s/n	**S-ID**	**JFN**	**OBP**	**NBP**	**Originator**	**Grade1**	**Grade 2**	**Grade 3**	**Date**	**V-No**

Table 1 is where the information captured are written down.

JFN = Job Function

OBP = Old best practice

NBP = New Best Practice

V-No = Version Number

12 ELDI Section Lookup Table

Table 2: Lookup Table for different sections in ELDI

S/N	S-ID	Section Name
1	Prd-001	Production Section
2	Res-002	Research Section
3	QC-003	Quality Control Section
4	Mkg-004	Marketing Section
5	Agc-005	Agricultural Section

Table 2 is a database table showing the different sections in ELDI, S-ID is the section identification number.

13. Dynamic Expert System Knowledge Repository

Table 3(a): Production Section Knowledge Repository

s/n	S-ID	JFN	CBP	Originator	Date	V-No
1	Prd-001	Giving each workforce a copy of policies and procedures that they are supposed to comply with immediately they are employed.	By CD or Physical Copy	001/05	21/2/2000	1
2	Prd- 001	Staff Recruitment	Recruiting staff with good/high quality IP content	001/11	23/7/2008	1
3	Prd-001	Staff Orientation and Training	Inculcate/Pass new ideas to them	001/12	16/6/1999	1
4	Prd-001	Teaching Staff on the need to have spirit of cooperation within and between department	By doing a new project together and sharing ideas	001/15	19/5/2010	1
5	Prd-001	Communicating job expectations to Staff	By Example	001/02	30/7/1994	1
6	Prd-0011	Planning the work stages	Use software tools	001/05	11/8/2012	1
7	Prd-001	Doing the work stages as staff watch	By Demonstrations	001/03	5/10/2007	1
8	Prd-001	Having a Score sheet containing names of every staff in this section	Having a list according to the staff id	001/11	29/9/1985	1
9	Prd-001	Scoring the workforce as they work	Be very objective. Do qualitative assessment	001/19	7/3/2000	1
10	Prd-001	Scoring the finished Product	Scoring, where the highest is 100% and the quality of work output is scored over 100%	001/32	28/4/2015	1

Table 3(a) is the database for Production section, comprising of job functions (JFN) and current best practices (CBP) done in Production Section

Table 3(b): Research Section Knowledge Repository

s/n	S-ID	JFN	CBP	Originator	Date	V-No
1	Res-002	Determine the goal of each research project	Develop sub objectives and milestones that indicate progress	002/16	15/10/2004	1
2	Res-002	Determines the best research method to adapt for each project	Through knowledge of the alternative practices on how the project could be done	002/12	24/1/2017	1
3	Res-002	Supervises a project	Work with team members with team spirit	002/22	26/1/2017	1
4	Res-002	Supervise the research staff	Set departmental and individual employee goals and provide routine evaluations of progress toward these goals. Identify and promote professional growth opportunities for staff. Ensure adherence to professional standards and ethics of prospect research	002/05	16/4/2004	1
4	Res-002	New Product Research	Conducts a thorough study to support the project, which includes determining product specifications, production costs and its time line, evaluation of the need for the product	002/07	23/10/2011	1
5	Res-002	New Product Development	New product is actually developed based on the requirements and ideas created during the research phase	002/19	18/12/2013	1
6	Res-002	Existing Product Updates	Evaluates the products offered by the company, resolve a problem with an existing product that malfunctions or to find a new solution if the manufacturing process must change.	002/19	2/11/2007	1
7	Res-002	Quality Checks	Has an intimate knowledge of the requirements and specifications of a particular project, collaborate with research and development on quality checks.	002/45	1/3/2003	1

8	Res-002	Innovation	Research and analyze the products other businesses are creating, as well as the new trends within the industry	002/38	20/12/2011	1
9	Res-002	Mixed methods research	Researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study	002/11	27/10/2010	1
10	Res-002	Repertory grid Interview	Carrying out an interview in a highly structured manner, using the interviewee's own language and setting out their responses in the form of a grid.	002/31	17/11/2008	1

Table 3(c): Quality Control Section Knowledge Repository

s/n	S-ID	JFN	CBP	Originator	Date	V-No
1	QC-003	Developing a quality Control Program	Ensure the staff know how they will be appraised	003/03	6/6/1999	1
2	QC-003	Directing a quality control program	Ensure each aspect of the work id done according to current best practices	003/21	26/9/2000	1
3	QC-003	Coordinating a quality control program	Documenting your processes and ensuring that the way the work is actually done matches the documentation	003/11	31/8/2004	
4	QC-003	Utilizing team members in collecting construction materials	Write out the product accurately and its detailed specifications	003/19	15/11/2008	1
5	QC-003	Analyzing construction materials to see that they are top quality	Always insist on the best quality material for the work	003/23	28/5/2001	1
6	QC-003	Reviews laboratory practices and procedures	Ensure the practices and procedure include adequate safety measures	003/15	12/3/2011	1
7	QC-003	Evaluate Safety practices and procedures	Use laboratory and field analytical work as measures	003/34	18/9/2009	1
8	QC-003	Prepares report to management and agencies	Reports should be objectively factual and to the point	003/11	2/1/2007	1
9	QC-003	Maintains safety material, datasheet, records on chemical and compounds used	Ensure the staff understand how to handle such materials safely	003/10	20/4/2011	1
10	QC-003	measure and evaluate the performance of your staff	Use quality control scorecards in the review process.	003/09	17/12/2013	1

Table 3(d): Marketing Section Knowledge Repository

s/n	S-ID	JFN	CBP	Originator	Date	V-No
1	Mkg-004	Overseeing Company's marketing campaign	Ensure targeted advertising to the expected buyer population. Evaluate how successful the campaign	004/05	4/5/2009	1
2	Mkg-004	Communicates to the public the organization marketing message	Make the message catchy, share and with product quality well emphasized	004/01	25/6/2014	1
3	Mkg-004	Prepares and plans the publications of the company publicity material	Ensure the publication leave the public with a positive image of the company	004/09	20/12/2002	1
4	Mkg-004	Managing the publications of the company publicity material to maximize round promotion	Try to place adverts in between NEWS. Use also NEWS adjacency and public holiday periods	004/009	2/5/2010	1
5	Mkg-004	Working with the company eternal public relation agency to see the marketing campaign executed	The campaign must capture a larger share of the product market for the company	004/10	15/3/2004	1
6	Mkg-004	Information dissemination to customers who contributed in annual sales and marketing plans	Recommend bonus as necessary. Make sure the people are in your mailing list for regular updates on product	004/31	31/6/2001	1
7	Mkg-004	Project managing marketing events	Ensure the market events are in line with the marketing plans	004/19	16/11/2014	1
8	Mkg-004	Evaluate the effectiveness of all marketing activities	Use scientific tools and standards to achieve qualitative evaluation	004/18	6/6/2006	1
9	Mkg-004	Support the marketing manager in day to day marketing activities	Make up your mind to put up with work pressure without murmuring	004/29	17/11/2003	1
10	Mkg-004	Plan, develop and deliver campaign as agreed within time scales	Match the delivered campaign times with the planned times and query any discrepancy	004/37	21/2/2001	1

Table 3(e): Agricultural Knowledge Repository

s/n	S-ID	JFN	CBP	Originator	Date	V-No
1	Agc-005	Determine when the environment is overgrown with weeds	Your aim must be to present a pleasant environment at all times	005/03	29/4/2004	1
2	Agc-005	Apply chemicals on the weed	Apply when the workforce are not around especially on weekends for safety purposes	005/28	23/9/2002	1
3	Agc-005	Fumigate to avoid pest like bats	Staff must not inhale poisonous chemicals or gases while on duty	005/04	15/8/2000	1
4	Agc-005	Landscaping the environment	Plant flowers and tress for beautification	005/29	16/8/20015	1
5	Agc-005	Keeping the trees and flowers neat at all time	Trimming and cutting down as necessary	005/30	30/6/2011	1
6	Agc-005	Construct agricultural machines	Design agricultural machinery components and equipment, using computer-aided design technology, ▪ Create graphical representations of mechanical equipment	005/22	21/3/1998	1
7	Agc-005	Provide advice on water quality and issues related to pollution management	▪ Advise others regarding green practices or environmental concerns.	005/31	19/4/2000	1
8	Agc-005	Test agricultural machinery and equipment to ensure adequate performance.	▪ Test performance of electrical, electronic, mechanical, or integrated systems or equipment.	005/11	7/6/1992	1
9	Agc-005	Conduct educational programs that provide staff with information that can help them improve agricultural productivity.	Train personnel on proper operational procedures	005/3	15/2/2003	1
10	Agc-005	Design sensing, measuring, and recording devices, and other instrumentation used to study the presents of pests and animal	Design electronic or computer equipment or instrumentation	005/21	15/6/2001	1

14. The Inference Engine Usage

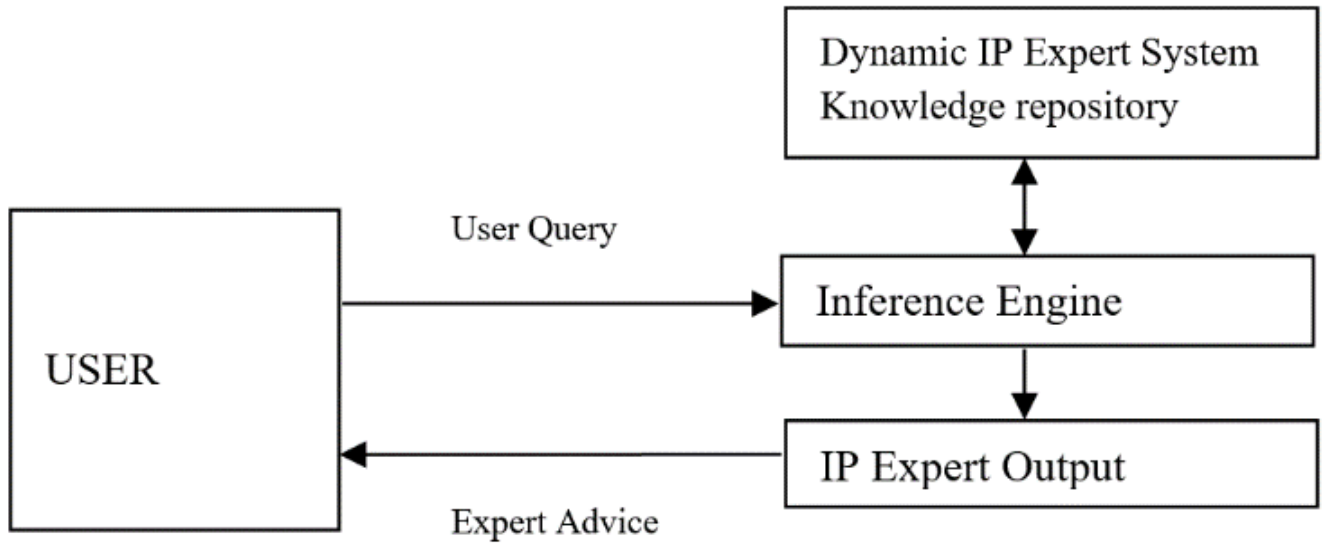

Fig 5: The Inference Engine Usage

User Query = Section Name of User
* Keywords where IP is desired
Inference Engine : Locates user section in the knowledge repository
* Searches for IP Matches
*Outputs IP + Current Best Practices

15. The Inference Engine Flowchart

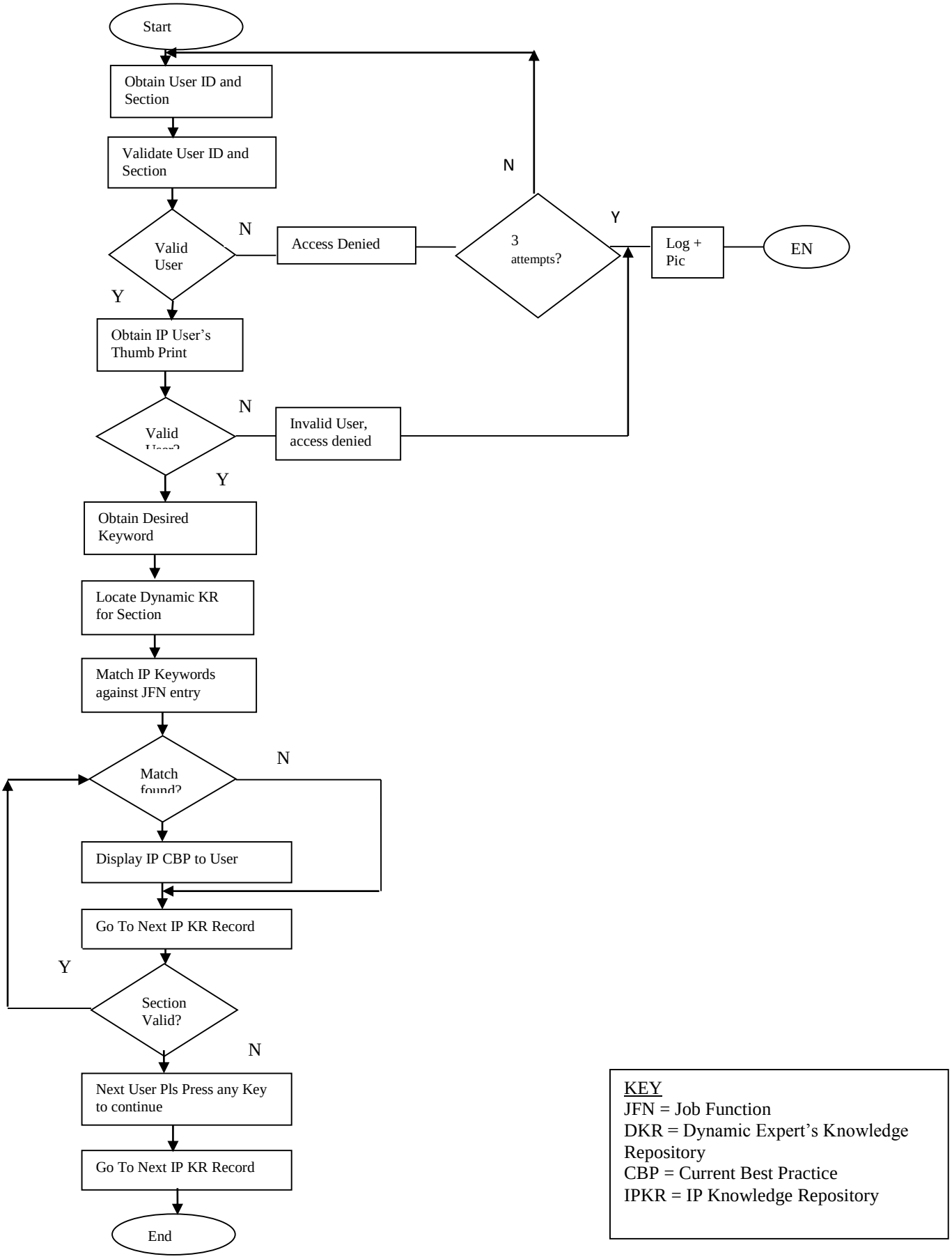

Fig 6: Inference Engine Flowchart

Fig. 6 is an Inference Engine flowchart showing how user obtains IP from Knowledge repository. A user who must be a staff of ELDI Company logs in with his user name and Password. The User name is the section name while the password is his staff ID, the system validates User and the section he/she belongs, if the valid is No, it denies him access, if he attempts loging up to 3 times, the system automatically takes his picture and logs his information. If the valid is Yes, it obtains the user thumbprint and compares it with the staff thumbprint, user name and password else it will deny it access, takes picture and log the information. The user searches with keyword, the Inference engine searches through the knowledge repository for matches for the keyword, it displays it if found, goes to the next KR record, validates the section again before the next search.

16. Comparism of Research Findings

This compares this research work with other jobs similar to it with the following parameters;

Table 4: Comparism of the Research Findings

s/n	Parameter Comparism	DES	IP databse storing idea, invention disclosure and Patent data	Intellectual Property Mgt in a global Economy using KPI	Kodak's Invention Tracker	Strategic mgt of IP; An Integrated Approach
1	Continuous search for new IP through quarterly knowledge elicitation exercise	Yes	Yes, Biannually	No	No	No
2	Remuneration package to encourage in-house new IP build up	Yes	Yes	Yes	Not stated	Yes
3	New IP validation through peer review of claimed new IP contribution	Yes	No	No	No	No
4	IP knowledge base enhancements through the replacement of old practices with the newly discovered industry best practices	Yes	No	No	Not Stated	No
5	Reduced cost of IP acquisition through the cost effective approach used	Yes	No	No	No	No
6	Provision of a means of measuring the net worth of new IP in a co-operate body	Yes	No	No	No	No
7	Simulation of workability of the dynamic expert system model	Yes	No	No	No	No
8	Encouragement for timely quality research output in engineering faculties of the universities by highlighting their potential earnings through such timely and patentable research	Yes	No	No	No	No
9	Expert IP valuation using the cost method	Cost based approach	Market based approach	KPI approach	Not stated	Not stated
10	Ability to make a company grow in effectiveness and capacity and remain continuously relevant through the adoption of the dynamic expert system model	Yes	No	No	No	No

17. Conclusion

An expert system Model for the automation of intellectual property (IP) for an organization has been presented in a manner that traps IPs or new IPs used for production within the corporate body. In the approach used in this research, the Intellectual property of the workforce is used to develop best practices and these best practices were evaluated by the foremen or the production manager or their equivalents. The efficiency and effectiveness of the company's workforce were kept at their best levels by insisting that every worker use only best practices for his or her job functions. Initially, a static expert system was built and then dynamically updated (every quarter) through knowledge elicitation techniques, knowledge base editing, and inclusion in the knowledge base of newly discovered best practices. This process is summed up in the dynamic expert system table of figure.3. An inference engine was also developed to facilitate decision making based on the knowledge repository (see Fig 6).

The decision structure of the case study organization ELDI was organized according to the groups of workforce namely: Production, Research, Quality Control, Marketing and Agriculture and a subset of the dynamic expert system knowledge repository catered for each of these production unit and ensure that the best practices patterning to them are kept together and made easily accessible to the workforce by means of the inference engine.

18. Contribution to knowledge

A new cost effective way for growing the Intellectual Property (IP) content of the workforce in a corporate body has been formalized in this research, through the concept of the dynamic expert system. This method traps productive IP of a corporate body within the corporate body with the result that even if key officers resign or withdraw their services for any reason, the company's productive capacity would not be much affected; other hands can easily be trained up to expectation by means of

the dynamic expert system. Thus those who leave the company could easily be replaced without much loss to the corporate body.

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