



## **DYNAMIC INTELLECTUAL PROPERTY CREATION MODEL (DIPCREAM) FOR WEB-BASED BUSINESS**

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**Abstract** - Web technologies evolve rapidly, hence websites needs to be continuously improved upon in both quality and content. Sophisticated tools may need to be deployed from time to time, enabling more complex interactions to take place. In order to gain new customers and to retain the old ones as repeat customers, the website must always be fine-tuned to match current businesses realities and sustain customers' interest. A typical Web Based Business may be broken down into five main components namely: e-commerce business strategy; promotional strategy and marketing hype, payment system, the quality of web pages and cyber security arrangement. Rapid technological innovation implies that the design of each of these components needs to be re-visited quite often in order to enhance the business website and make it relevant to current business realities. Revisiting of web based IP creation in short time periods makes the process dynamic and this is the approach used in this paper. Innovation in the creation of web pages is hardly captured and patents are easily pursued. The dynamic IP creation model for web based business will capture innovation from point to point as new ideas come onboard. This paper added a way to prompt businesses to be inclined towards rapid innovation, largely because of the patenting and remuneration incorporated for the inventors. In order to have a look ahead facility that would indicate how the model will behave in the future, the proposed model developed was subjected to Monte Carlo Simulation leading to the realization of a model equation for the Web Based Business (name withheld) used as a case study. A linear fit of the table of results of the simulation gave a coefficient of determination of 98.82%, which shows that the model is usable for forecasting purposes. The model equation may differ from business to business as parameters are fine-tuned to match each business but the approach is the same for all Web Based Business. Newly created IP for any component of a Web Based Business may be patentable depending on its quality.

**KEYWORDS:** Dynamic, Intellectual property Creation, Web-Based Business Simulation, Model Equation.

### **1. Introduction**

This paper focuses on Web Based Processes and Dynamic growth of Intellectual Property (IP) used by the workforce to execute their processes.(Abdullah. S.2016). A typical Web Based Business can be broken down into the following components: (a) E-Commerce Business strategy. (b) Promotional Strategies and Marketing hype. (c) The payment System. Echekoba F.N (2012) (d) The quality of Web Pages. (e) The Cyber Security arrangement. Though it is good to align web strategy to business strategy. Latif. A (2009)

There are various kinds of payment systems available today but one must make sure that the one selected ensures security of earnings and monetary transactions, simplicity of payment process, low transaction cost, high speed of payment processing and efficiency of process for online shoppers. Electronic payment cards available for online shopping include Credit Cards, Debit Cards and Charge Cards. Payments can also be made online by means of Virtual Credit Cards such as E-cash (Electronic cash), E-wallet (or E-purses); Smart Cards and Electronic Checks (E-checks). Other variations

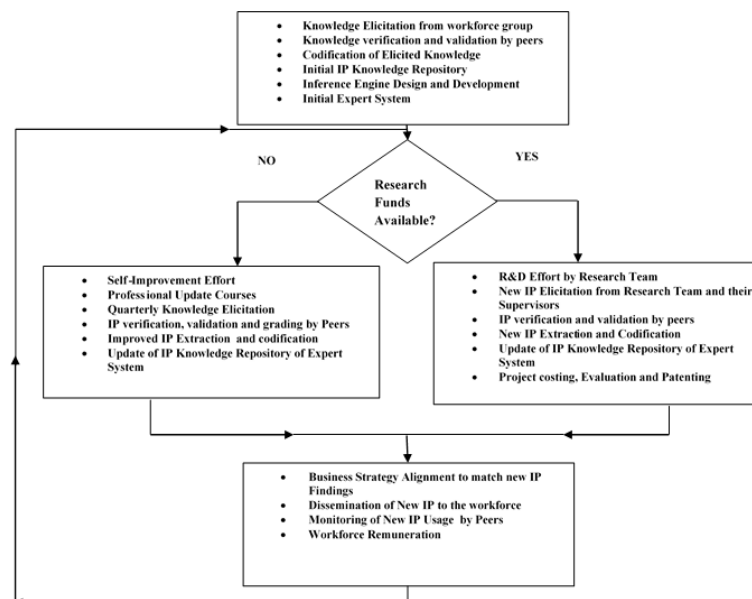
of Electronic cash exist such as wireless payments, stored value card payments, loyalty cards and payments made electronically at kiosks (Gary .P. S. (2013)& Peter . G (2001)). The website quality attributes include content quality, design aesthetics, and user friendliness. Cyber Security in e-commerce includes securing credit card numbers and personal data of perhaps, millions of customers and the official data (names, titles, positions, contact phone numbers, account and salary payments details etc.) of web business staff. The data ought not to be compromised. The e-commerce business strategy or business model defines whether the web business will sell to consumers, to businesses or to both. One's model may require building an online market where lots of business can sell together. Because Web technologies evolve rapidly, websites need to be continuously improved upon in quality. Sophisticated tools may need to be deployed from time to time, enabling complex interactions to take place. In order to gain repeat customers, the web site must always be fine-tuned to match the current interest of customers. A better, more appealing payment system may be upgraded to safeguard vital data and protect the owners' bottom line.

Rapid innovation implies short life span of current websites as business models may be revisited to match current trends and the marketing hype and promotional strategy may change rapidly. This means that online business has tremendous opportunities for IP creation in each of the components making it Web Based. The IP creation model can be encouraged and catalyzed. In the context of this paper, Web business workforce is roughly classified into the following categories;

- (a) Junior Knowledge Worker
- (b) Junior Administrative Staff
- (c) Senior Knowledge Workers (among these are the Operation managers)
- (d) Senior administrative Staff, and
- (e) Top Management Staff (Cyber Security Expert, Deputy Director and Director)

All the workers in the above category must be literates in computer operations, cybersecurity conscious, this will enable them see better ways of carrying out their day to day processes, by these, all workers are exposed to Computer and Information Technology. One way of dynamic IP creation for Web Based Business is the subject of the next few sections of this Web Based Business Paper.

## 2. The Dynamic IP Creation Model



**Fig 1: Dynamic IP Creation Model for Web Based Business (DIPCREAM) (Nwobodo L.O & Inyiama H.C, 2017)**

Dynamic IP Creation Model for Web Based Business (DIPCREAM) (Nwobodo L.O & Inyiama H.C, 2017), denotes an initial expert system that enhances as more knowledge is gained by replacing the older knowledge with the new ones. Fig 1 explains that knowledge can be obtained through a self-improvement exercise or R&D effort done by the team of researchers after which they are interviewed by a knowledge engineer to elicit new knowledge. That is used to update the knowledge repository of the Expert System and also made available for the entire workforce. Summarily, the following steps are taken to create the initial static IP model (Fig 1): Knowledge Elicitation from workforce group, Knowledge verification and validation by peers; Codification of Elicited Knowledge, Initial IP Knowledge Repository, Inference Engine Design and Development and Initial Expert System. After these, if there is a research fund available, the following steps are taken (Fig 1): Research and Development(R&D) Effort by Research Team; New IP Elicitation from Research Team and their Supervisors; IP verification and validation by peers; New IP Extraction and Codification; Update of IP Knowledge Repository of the Expert System and Project costing, Evaluation and Patenting. If there are no research funds available, the staff still tries to improve on their IP content through the following (Fig 1): Self Improvement Effort, Professional Update Courses, Quarterly Knowledge Elicitation, IP verification, validation and grading by Peers, Improved IP Extraction and codification; Update of IP Knowledge Repository of the Expert System. At the end of each quarterly exercise, the following actions are taken: Business Strategy Alignment to match new IP Findings; Dissemination of New IP to the workforce, Monitoring of New IP usage by Peers; and Workforce Remuneration. The dynamic loop causes the process of new IP creation to be repeated every quarter. This leads to a steady increase in new IP for each web business component which are then used to replace the old less attractive IP previously in use.

## 2. Literature Review

Nowadays, Intellectual Property makes up an increasing share of the company's resources. It is necessary for companies to manage their IP and as well protect it. Currently, it is a software tool used to attract investors (Glass & Saggi, 2002, Smarzynska, 2004) and create wealth (Schneider, 2005). It has also been recognized as a source of competitive advantage (Singh, 2015). Managing IP properly prevents firm innovations from being exposed and explored by competitors, giving the companies a portion of market power and, sometimes, monopoly power, materialized in the exclusive use and commercialization of their innovations, since they are legally protected from potential violations (Sey, 2010).

Intellectual Property creation model seems to help companies create and sustain competitive advantage in several ways (Reitzig, 2004a). It can provide a temporary technological lead (incumbency advantages), help to establish a standard in the market, and to protect key components of the firm. Marcus and Holgersson (2019) wrote on Intellectual Property in Technology transfer offices, they focused on privatizing research results through patenting, but didn't write on how the IP will be created and protected.

## 3. Materials and Method

The Matlab software used was developed by the authors and was modeled for empirical simulations of Monte Carlo.

## 4. Simulation of Intellectual Property (IP) creation in Web Based Businesses.

A simulation of the Dynamic IP Creation Model for Web Based Business of Fig. 1 was done to be a lookup model to know what the outcome of DIPCREAM would be in the next five (5) years (20 quarters). New IP is captured every three months, which is four (4) times a year. Five year of the simulation covers 20 quarters. On the average, each section of the Web Based Business Company can add from 0 to 4 new IP per quarter. By the use of a Monte-Carlo software for simulation made it possible to work out numbers of new IP per section per quarter via random number generation.

**5. IP Improvement probabilities:** Probability is the branch of mathematics concerning numerical descriptions of how likely an event is to occur, or how likely it is that a proposition is true. The probability of an event is a number between 0 and 1, where, roughly speaking, 0 indicates impossibility of the event and 1 indicates certainty. From the experiences of the experts, it was found that the following probabilities apply;

- a) The Probability that no IP improvement will be found per quarter  $P_0 = 0.1$
- b) The Probability that ONE IP improvement will be found per quarter  $P_1 = 0.2$

- c) The Probability that TWO IP improvement will be found per quarter  $P_2 = 0.4$
- d) The Probability that THREE IP improvements will be made per quarter  $P_3 = 0.2$
- e) The Probability that FOUR IP Improvements will be found per quarters, for the same aspect of a web process is 0.1 i.e.  $P_4 = 0.1$
- f) The probability of finding more than FOUR IP per quarter is zero = 0

**Table 1: Probability allocation**

Probabilities for New IP Creation	0.1	0.2	0.2	0.4	0.4	0.4	0.4	0.2	0.2	0.1
No of new IPs Created	0	1	1	2	2	2	2	3	3	4
Random Number Generated	1	2	3	4	5	6	7	8	9	10

Probability is the likelihood or ratio that an event will occur. 0.1, 0.2, 0.4 etc. are figures that shows proportions, for example, 0.1 = 10%, 0.2 = 20%, 0.4 = 40% etc.

Monte Carlo Simulation was used to determine the number of new IPs created per quarter using probabilities allocated as shown in Table 2. In this a random number whose value lies between 1 and 10 inclusive is generated per quarter. The number of new IPs created in that quarter can be read off from the middle row of Table 1 and this matches the probabilities allocated. The category of Web Workers that contributed the IP can be 1 of 5 as shown in Table 2.

**Table 2: Web Worker Categories**

S/N	Category of web worker
1	Junior Knowledge Worker (JKW)
2	Junior Administrative Staff(JAS)
3	Senior Knowledge Worker(SKW)
4	Senior Administrative Staff(SAS)
5	Top Management Staff(TMS)

The particular Web Business component, the person could contribute a new IP is shown in Table 3.

**Table 3: IP Type and Abbreviations**

Category	IP Type (Web Business Component)
1	Business Strategy (BZS)
2	Marketing Hype (MHY)
3	Payment System (PMS)
4	Quality of Web Page (QWP)
5	Cyber Security Arrangement (CSA)

Thus, in Monte Carlo Simulation, a random number (1-5 inclusive) is generated and used to determine the web worker making the contribution. Similarly, another random number (1-5) inclusive is used to determine the IP Type which is the Web Business Component (Table 3) on which the person is making a contribution. In Table 4. Every candidate is represented with a three-digit IP number generated randomly, digit by digit. This is represented in Table 4 as AID(Auto ID), See Table 4.

**Table 4: Remuneration and Worth Table**

S/N	I	NIP	COWW	IPC	AID	QIP	REMUNERATION (₦)	WORTH (₦)
1	1	1	JAS	MHY	238	2	12,020.4	24,040.8
2	1	1	SAS	MHY	431	3	18,022	45,055
3	2	1	TMS	PMS	557	1	20,000	35,000
4	3	3	SKW	QWP	872	1	48,359.2	84,628.6
5	3	3	JKW	BZS	115	3	13,110.3	32,777
6	3	3	SKW	QWP	862	3	5,002.8	12,507
7	4	1	JAS	BZS	212	1	69,285.92	121,250.36
8	5	2	SAS	PMS	443	1	44,080	77,140
9	5	2	SAS	CSA	986	1	23,524	41,167
10	6	0						
11	7	4	TMS	CSA	986	2	23,425.38	46,850.76
12	7	4	JAS	QWP	279	1	45,724.88	80,018.54
13	7	4	SKW	PMS	341	3	25,242.8	63,107
14	7	4	TMS	CSA	595	3	23,508	58,770
15	8	2	SAS	MHY	428	3	13,082	32,705
16	8	2	SAS	QWP	473	2	38,700	77,400
17	9	2	JKW	PMS	643	2	11,070	22,080
18	9	2	TMS	PMS	546	3	35,880.4	89,701
19	10	2	TMS	MHY	521	1	62,428.56	109,249.98
20	10	2	SAS	QWP	471	1	18,436.56	32,263.98
21	11	1	SKW	BZS	315	3	32,004	80,010
22	12	1	JAS	BZS	214	3	28,841.2	72,103
23	13	4	TMS	PMS	943	2	10,818	21,603.6
24	13	4	SKW	BZS	316	1	51,604.48	90,307.84
25	13	4	JAS	BZS	711	3	22,548	56,370
26	13	4	TMS	QWP	962	1	74,560	130,480
27	14	1	SKW	CSA	381	1	47,762.4	83,584.2
28	15	2	JAS	QWP	768	2	10,314	20,628
29	15	2	SKW	MHY	837	2	54,013.8	108,027.6
30	16	3	SKW	PMS	847	1	53,627.2	93,847.6
31	16	3	JAS	MHY	226	3	18,368	45,920
32	16	3	SAS	CSA	988	1	65,735.2	115,036.6
33	17	3	SKW	CSA	897	3	33,140.12	82,850.3
34	17	3	SKW	MHY	822	2	41,251.2	82,502.4
35	17	3	SAS	QWP	478	2	27,474.18	54,948.36
36	18	3	SKW	CSA	389	2	13,905.9	27,811.8
37	18	3	SAS	PMS	447	3	34,293.6	85,734
38	18	3	SKW	PMS	843	1	76,888.8	134,555.4
39	19	1	SKW	PMS	346	3	31,569.52	78,923.8
40	20	2	TMS	MHY	528	1	44,197.76	77,346.08
41	20	2	SKW	MHY	336	1	51,395.84	89,942.72
<b>TOTAL</b>							<b>1,375,216.4</b>	<b>2,718,245.32</b>

Table 4 represent the remuneration and worth table, with headings:

NIP= representing the numbers of Intellectual Property (IP).

COWW= Category of Web Worker.

IPC= Intellectual Property Component.

AID = Auto ID

QIP = Quality of Intellectual Property (QIP)

Remuneration = The amount given to contributors of IP



Worth = What the IP worth to the company

**Table 5: Allocation of Grade of IP during Simulation**

<b>Probability</b>	1/3	1/3	1/3	1/3	1/3	1/3
<b>New IP Grade</b>	1	1	2	2	3	3
<b>M Modulo 6</b>	0	1	2	3	4	5

This means that each of the three IP grades has equal probabilities of occurring namely a probability of  $2/6 = 1/3$ . (Table 5) This approach was informed by expert advice on the probability of each IP grade type.

The incentives paid to each knowledge worker for new IP contribution are calculated as follows;

- a) 8% of extra profit earned in the Web Business attributed to improvement in IP rated grade 1, is paid out as remuneration to the inventor(s).
- b) 6% of every profit earned in the Web Business attributed to improved IP rated grade 2, is paid out as remuneration to the inventor(s).
- c) 4% of extra profit earned in the web business which is attributed to IP improvement rated grade 3, is paid out as remuneration to the inventor(s).

The Worth of an IP is the value the IP earns for the company, which is: Profit - Remuneration

Where more than one IP improvement occurred per quarter the remuneration for that quarter is shared according to the grades of IP, for example, if in a quarter, 3 new IPs are discovered rated grade 1,2,3, the person in IP of grade 3 will take 1 unit of profit, the person with grade 2 IP will take 2 units of profit and the person with grade 1 IP will take 3 units of Profit. The profit is determined by the highest grade represented in the IP improvement. In this grade, the highest grade is grade 1, therefore the IP improvement shall be 8% of extra profit earned which is attributable to the IP improvement. This will be split into unit as follows: 1 unit to the person with new IP grade 3, 2 units to the person with new IP improvement of grade 2 and 3 unit to the person with new IP improvement of grade 1. This informs the amount indicated in the profit and remuneration columns of table 4. The profit column shows the extent of improvement attributable to the newly created Web Business IPs. The worth column in Table 4 (which is also the last column) shows the actual worth of the new IPs to the Web Based organization. The worth (Gain) to the company is Profit minus Remuneration.

**Table 6: New IP gain for 5 Years of Simulation**

S/N	SCOD	SCODE Name	No of IP	Cost of IP (₦)	Worth of IP (₦)	Profit of IP (₦)
1	JKW	Junior Knowledge Worker	5	24,180.3	54,857	30,676.7
2	JAS	Junior Administrative Staff	16	207,102.43	421,162.92	214,060.49
3	SKW	Senior Knowledge Worker	36	565,768.06	1,112,606.26	546,838.2
4	SAS	Senior Administrative Staff	20	283,347.54	561,449.94	278,702.4
5	TMS	Top Management Staff	23	296,552.9	569,001.42	272,448.52
Total			100	1,376,951.23	2,719,077.54	1,342,726.31

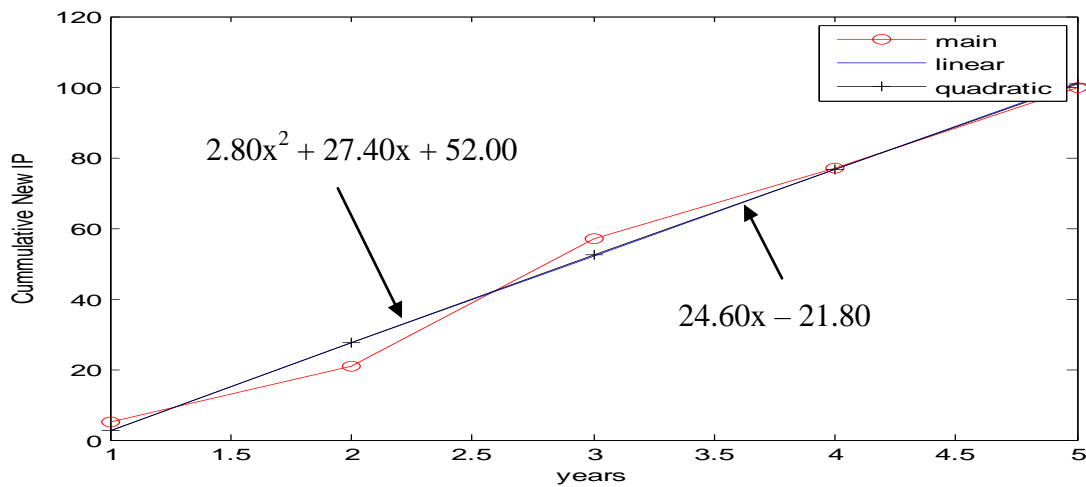
Table 6 represents the total number of IP throughout the year of simulation, the total cost of IP, the worth of IP to the Web Company and profit the company made during the simulation. A total of 100 IPs was acquired in 5 years of 20 quarters. The cost of IP in terms of remuneration is ₦ 1,376,951.23, though the IPs worth ₦ 2,719,077.54, making a gain of ₦ 1,342,726.31. This means the company

remunerated the owners of the IP and also made their gain.

**Table 7: Cumulative IP gain in 20 quarters.**

S/N	1	2	3	4	5
<b>SCOD</b>	5	16	36	20	23
<b>Cumulative IP</b>	5	21	57	77	100

This is a cumulative of all the IP gained in five years of simulation (Table 7). A total IP of one hundred was gotten during the years.



**Fig 2: Graph plotting showing Cumulative New IP gained over the years of simulation.**

Fig 2 shows the values of new IP fitted to a straight line of best fit and also to a quadratic curve to show which fits better. The idea is to find out whether the outliers of the straightline graph suggest a linear fit or a quadratic. Indeed, the linear seem to be a better fit for the values in table 7. A Matlab software was used to generate the graphs of fig 2. This was further reinforced by the coefficient of determination

for the linear fit, where linear fit has the same percentage (98.82%) using the formulae:

$$R^2 = \frac{\text{Explained Variation}}{\text{Total Variation}} = \frac{\Sigma(Y_2 - \bar{Y})^2}{\Sigma(Y_1 - \bar{Y})^2} * 100\%$$

Where,  $R^2$  = coefficient of determination  
Or

$R^2$  = The square of the correlation coefficient, R

**Table 8: Coefficient of determination for linear fit**

X	Y <sub>1</sub>	Y <sub>2</sub>	Y <sub>2</sub> - $\bar{Y}$	(Y <sub>2</sub> - $\bar{Y}$ ) <sup>2</sup>	Y <sub>1</sub> - $\bar{Y}$	(Y <sub>1</sub> - $\bar{Y}$ ) <sup>2</sup>
1	5	2.80	-49.2	2,420.64	-47	2,209
2	21	27.4	-24.6	605.16	-31	961
3	57	52	0	0	5	25
4	77	76.6	24.6	605.16	25	625
5	100	101.2	49.2	2,420.64	48	2,304
	$\Sigma 260$			$\Sigma 6,051.6$	$\Sigma 6,124$	

$$\Sigma Y = \frac{Y_1}{5} = \frac{260}{5} = \bar{Y}$$

$$\bar{Y} = 52$$

$$\frac{\text{Explained Variation}}{\text{Total Variation}} = \frac{\Sigma(Y_2 - \bar{Y})^2}{\Sigma(Y_1 - \bar{Y})^2}$$

$$= \frac{6,051.6}{6,124}$$

$$R^2 = 98.82\%$$

R<sup>2</sup>= Coefficient of Determination for the quadratic fit, R<sup>2</sup> becomes,

$$R^2 = 98.82\%$$

**6) Result Discussion**

The simulation result in Table 5 was further summarized to show new IP gain and cumulative IP gain in Table 7 & 8 respectively within the twenty (20) quarters of the simulations.

**Conclusion**

Dynamic Intellectual Property Creation Model (DIPCREAM) for Web Based Business was modeled to help workforce to continuously have new and better ways of carrying out their processes, it is also enhanced as more knowledge is gained. DIPCREAM was

simulated for 20 quarters with Monte Carlo which determines new IP using probabilities to determine the Web Based components and their contributors. An incentive is paid to any contributor of new IP. A total of 100 (one hundred) new IPs were gathered throughout the time of simulation. The values of the new IPs were fitted into a linear fit with coefficient of determination of 98.82%. It means that the model can be used for forecasting in the future.

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