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Theme: Smart and Intelligent Civilization

February 22 - 24, 2017

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Host and venue:
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Babolsar, Iran

Supported by:
Korea Database Society
Korea Database Agency

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Smart and Intelligent Civilization

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C0-host: Korea Database Society, International ITAM Society

[PROGRAM]

I. Symposium: Future of Asia (22nd of February, 2017)

II. Conference ITAM (23rd of February, 2017)

Time	Program
8:00~9:00	**Registration**
9:00~10:30	**Inauguration Session**
	1) Opening Announcement -Iraj Mahdavi (Chair of Organizing Committee, MUST, Iran) **2) Welcome Greeting** - Abdolresa Sheikholeslami (Chancellor, MUST, Iran) - Tahmasbi (Director, Mazandaran ICT, Iran) 3) **Keynote Speech** **Technology and Management Education for Intelligent Society** - Namjae Cho (Conference General Chair, Hanyang U., Korea) 4) **Keynote Speech** **Technology and Management Education for Intelligent Society** **Smart Industry in the Digital Economy: Industrial Aspects and Production Systems** Professor Kanes K Rajah*(Royal Agricultural University, Cirencester, Gloucestershire*}

Time	Track A	Track B
10:30 ~12:00	**Session A1** IT Application	**Session B1** Information Technology
	Chairperson: Uthai Tanlamai (Chulalongkorn U., Thailand) a. Sateesh Kumar Ojha: Rewarding Practices in the Organizations of Developed and Developing Countries for Employee Productivity b. Reza Tanzifia and Iraj Mahdavib*:* From Word Embedding to Inferring user latent Interests c. Juthathip Audsabumrungrata and Sarun Chookhiattib*:* The Effectiveness of Applying Augmented Reality Visualization in Teaching Audit Risk Model Concept	Chairperson: Seokha Koh (Chungbuk Nat'l U., Korea) a. Seyedeh Fatemeh Hashemia, Iraj Mahdavib and Hamed Fazlollahtabarc: Intelligent Design Thinking for Value Creation in the Digital Society b. Mostafa Safdari Ranjbara, Iraj Mahdavib, Namjae Choc, Gholam Reza Tavakolid*:* Selecting Technology Acquisition Strategy through Applying PROMETHEE Method: An Industrial Automation Equipment Manufacturer c. Bagher Rahimpour Kamia, Ali Davoudib, Hesamodin Pourkarim Dodangehc and Mohammad Reza Hassanpour Charmchid*:* Paths-oriented Test Data Generation using Genetic Algorithm
12:00~1:30	**Lunch**	
1:30 ~3:00	**Session A2**: Cyber Community	**Session B2**: Management of Technology
	Chairperson: Sateesh Kumar Ojha (Tribhuvan University, Nepal) a. Yanki Hartijasti*:* Preliminary Study on How to Manage People at Sharing Economy Organizations b. Uthai Tanlamaia, Aim-Orn Jaikengkitb, Teerayout Wattanasupachokec c. Homayun Motameni and Mohammad Hesam Ebrahimpourb*:* The Survey and Future Evolution of Failure Transparency and Recovery Techniques d. Homayun Motamenia and Kiarash Ardeshiry lajimib*:* Fault Tolerance Mechanism and Recovery Approach	Chairperson: Chen-Chang Chen (Tamkang University, Taiwan) a. Sung Kun Kim and Jin Yong Kim: Are Critical Success Factors of BI Systems Really Unique? b. Nesa Shafighi, Babak Shirazi, Iraj Mahdavi*:* Ontological Map of Service Oriented Architecture based on Zachman Framework c. Azahar Alam, Chandan Bhar*:* Development of Open-shop Scheduling algorithm for solving Cross-docking Problem d. Kyeong-Min Leea, Caleb Vununua, Suk-Hwan Leeb, and Ki-Ryong Kwona: Fault Diagnosis of Cutting Drill Machinery through Artificial Neural Networks of Sound Signals
3:00 ~3:30	**Coffee Break**	

3:30 ~5:00	**Session A3** IT and Organization	**Session B3** Innovation Management
	Chairperson: Yanki Hartijasti (University of Indonesia, Indonesia) a. ZohreKiapasha,IrajMahdavi, Hamed-Fazlollahtabar: Applying Eye Tracking to Detect Health and Recovery Process b. Sateesh Kumar Ojha: Grievance Procedures in the Cross Country Organizations: a Powerful key to Employee Retention c. K.T. Hwang & Yong Geun Lee*:* A Management System for Information Systems Operational Performance d. Intara Tanlamaia*:* Flexible Working Arrangements: A Case Study of IT-SMEs in Thailand	Chairperson: Iraj Mahdavi (MUST, Iran) a. Swopnil Ojha: Impact of ICT to Minimize Earthquake Effect b. Mojtaba Zahedi Amiria and Abdullah Shobib*:* A Link Prediction Strategy for Personalized Tweet Recommendation Through Doc2Vec Approach c. kamran farajzadeh , Omid zare a, Dr. Homayun Motamenib*:* Data Security and Privacy Issues in Cloud Computing e. Mahesh Maharjan & Swopnil Ojha*:* ICT and Civil Registration: Basic Service Delivery, National Impact
5:00 ~5:30	**Valedictory Session** **1) Closing Address** - Namjae Cho (Conference General Chair, Hanyang University, Korea) **2) Announcement of the Next Conference** - Dai Weihui (Fudan University, China)	
6:00 ~9:00	**Banquet**	

III. Conference Field Trip (24th of February, 2017)

- **Industrial visits in the state of Mazandaran.**

Development of Open-shop Scheduling Algorithm for Solving Cross-docking Problem

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Abstract

Cross docking is a warehousing strategy that involves movement of material directly from the receiving dock to the shipping dock with a minimum processing time. Concept of cross-docking is not new but has gained enough attention with the growth of e-commerce industries. In this paper, a cross-docking problem has been presented as an open shop problem and an algorithm has been developed for solving the problem. Since, the problem is combinatorial in nature, an algorithm based on Genetic Algorithm (GA) combined with Neighborhood Search Method (NSM) has been proposed for solving such problem. Computational result obtained through the application of the proposed algorithm has been presented in the paper, which shows that there is improvement over the previously obtained solutions.

Keywords- Cross-dock, Open-Shop, Genetic Algorithm, Neighborhood Search.

Introduction

Cross-docking is a logistics method in which products delivered from a warehouse by in-bound trucks are sorted-out and rearranged based on demand of customer and are loaded into out-bound trucks for delivery to customers without being held or held for very short duration in the warehouse. Shipments commonly spend few hours in a cross-docking terminal, sometimes less than an hour. While comparing with traditional warehouses, a cross-docking system can reduce the storage and products retrieval costs by combining the flows of in-bound and out-bound trucks. Further, the employment of cross-docking system in warehousing ensures advantageous result like decrease in inventory levels, operational costs, delivery time, and increase in the level of customer satisfaction. Fast and efficient supply chain is the need of the era due to tremendous growth in e-commerce, which has made customers even more impatient than earlier. In a fierce competition, an efficient supply chain proposes "just in time" approach to logistics. The application of the cross-docking concept is necessary to cope up with this challenge. An exhaustive review of literature is done by Van Belle, Valckenaers, & Cattrysse related to cross-docking [15]. In this review, variety of questions related to cross-docking has been identified [15]. It has been found that cross docking is

a technique, which assists to reach distribution centers (DCs) more efficiently. Five basic functions are typically carried in a DC that includes receiving, sorting, picking and shipping [16]. One of the most important goals of cross-docking is to employ full truck load (FTL) policy instead of sending trucks by using less-than truck load (LTL) policy. Since, LTL policy might cause additional transportation costs, full capacity of a truck may be utilized by shipping differently sized packages in the truck, which would be more economical [1]. A study by the Saddle Creek Corporation reportedthat there is a significant increase in the number of firms that utilizes cross-docking as part of their supply chain [11]. There are two important operational decisions that leads to the majority of operational costs at a cross-docking: (1) assigning truck to dock-doors; and (2) scheduling truck at the cross-docking station. Both in-bound and out-bound trucks at a cross-docking must be assigned to a specific dock-door for the processing of consignments. Improper assignments of truck to doors can result in excessive operational costs within the cross-docking. Cross docking is a logistic strategy and has received a lot of attention in the last few years. Many companies use cross dock networks to reduce inventory, material handling, and transportation costs. Cross docking reduces the items' price significantly, as 30% of an item's price is related to the distribution process[2]. Successful implementation of such systems in popular companies like Wal-Mart, Goodyear GB Ltd, Toyota, Eastman Kodak Co., and Dots, LLC shows that this strategy can considerably decrease distribution costs [15]. The cross docking implementations in different companies such as Wal-Mart [12], Goodyear GB Ltd [9] and Dots [10] show its importance in the competitive situations.

Methodology

In this paper, cross-dock scheduling problem has been considered as an open shop scheduling. In an open shop environment, *n* number of jobs are processed on *m* number of machines in an arbitrary order (i.e., job processing route is not pre-defined). Similarly, in cross-dock scheduling problem, in-bound truck has to unload items which has to be loaded on out-bound truck, which will deliver those items to the destination(s). In this study, an attempt has been made to schedule the trucks at cross-dock station(s). Like open shop scheduling, it is considered that cross-dock scheduling will process all in-bound trucks and out-bound trucks in an arbitrary sequence. In general, open shop scheduling problem considers a job set $N = \{1,2,\ldots n\}$ in which job j, where $j \in N$ has to be processed on a set of machine $M = \{1,2,\ldots m\}$ in which machine i, where $i \in M$. Since, the case is considered as open shop scheduling problem, hence there is no restriction regarding the order on which job has to be processed and vice-versa, i.e., the order of processing is arbitrary. The processing of job j on machine i is denoted as O_{ij} and time required to process the job is denoted by p_{ij}. It is assumed that processing time is independent of processing order considered and is known in advance (i.e., deterministic). At any given point of time, one job can be processed on one machine only and vice-versa. Since, the basic case of open shop scheduling is considered, so preemption is not allowed, i.e., once a process is started then it will continue until the process is finished. Completion time of the job j where $j \in N$ is denoted by C_j when single machine is taken into consideration and notation C_{ij} will be used when more than one machines are considered, where iϵM. The objective of this study is to determine the sequence, which gives the minimum makespan (starting of the first job to completion of the last job). The classical scheduling notation scheme suggested by Graham et al. [6] is of the form $\alpha|\beta|\gamma$, where α indicates about machine environment i.e., single machine, two machines, multiple machines etc. β gives information about constraints and characteristics of scheduling. While, γ specifies the decision criteria for optimization. As per this notation, the problem considered is represented as $O_m||$. Another form of representation of the problem is $O_m|n=km|$, where number of jobs is multiple of number of machines and k = a positive integer. This paper considers $O_m||$ form of representation, where both square (where number of in-bound and out-bound trucks are same) and non-square (where number of in-bound and out-bound truck are different) problem are considered.

Notation used in formulation of the problem-

M = a very large positive number;

m = number of out-bound truck on the dock-station;

n = number of in-bound truck for processing at beginning of operation;

J_i = in-bound truck number i;

M_k =out-bound truck number k;

r_{ik} = 1 if J_i requires M_k; 0 otherwise;

N_i = number of operations of J_i, this is, N_i =;

O_{ijk} = operation number j of J_i on M_k;

s_{ijk} = the starting time of O_{ijk}

p_{ik} = processing time of J_i on M_k;

C_{max} = maximum completion time or makespan; C_{max} = ;

x_{ijk} =1 if J_i is scheduled in the j^{th} position for processing on M_k; 0 otherwise.

= 1 if O_{ijk} precedes $O_{i'j'k}$ (not necessarily immediately); 0 otherwise;

The formulations of the optimization model are stated as follows.

Minimize, C_{max} (1)

Subject to the constraints,

$x_{ijk} \le r_{ik}$ $i = 1, 2, \ldots, n; j = 1, 2, \ldots, N_i; k = 1, 2, \ldots, m$ (2)

$= r_{ik}$ $_i$ =1, 2, …, n; $k = 1, 2, \ldots, m$ (3)

$= 1$ $i = 1, 2, \ldots, n; j = 1, 2, \ldots, N_i$ (4)

$s_{ijk} \le M x_{ijk}$ $i = 1, 2, \ldots, n; j = 1, 2, \ldots, N_i; k = 1, 2, \ldots, m$ (5)

$s_{ijk} + p_{ik} \le s_{i,j+1,k'} + M(2 - x_{ijk} - x_{i,j+1,k'})$ $_i$ =1, 2, …, n;

$j = 1, 2, \ldots, N_i - 1$; $k, k' = 1, 2, \ldots, m$ and $k \ne k'$ (6)

$s_{ijk} - s_{i'j'k} \ge p_{i'k} - M(2 - x_{ijk} - x_{i'j'k}) - M(1 -)$

$1 \le i < i' \le n; j = 1, 2, \ldots, Ni; j' = 1, 2, \ldots, Ni'; k = 1, 2, \ldots, m$ (7)

$s_{i'j'k} - s_{i'k} \ge p_{ik} - M(2 - x_{ijk} - x_{i'j'k}) - M$

$1 \le i < i' \le n; j = 1, 2, \ldots, Ni; j' = 1, 2, \ldots, N_{i'}; k = 1, 2, \ldots, m$ (8)

$s_{i,Ni,k} + p_{ik} \le C_{max}$ $i = 1, 2, \ldots, n; k = 1, 2, \ldots, m$ (9)

$C_{max} \ge 0; s_{ijk} \ge 0$ $i = 1, 2, \ldots, n; j = 1, 2, \ldots, N_i; k = 1, 2, \ldots, m$

x_{ijk} is binary i = 1, 2, …, n; j = 1, 2, …, N_i; k = 1, 2, …, m

is binary k = 1, 2, …, m; 1 ≤ i < i′ ≤ n; j = 1, 2, …, N_i;

j′ = 1, 2, …, $N_{i'}$; (10)

In the above model, constraint sets (2) to (4) describe the feasible value of x_{ijk}. Constraint set (5) ensure that $s_{ijk} = 0$, when $x_{ijk} = 0$. Constraint set (6) ensures that processing of $O_{i,j+1,k'}$ can be started only after O_{ijk} is finished. Constraint sets (7) and (8) together ensures the requirement that only one operation may be processed on a machine at a time. This indicates either $s_{ijk} - s_{i'j'k} \ge p_{i'k} - M(2 - x_{ijk} - x_{i'j'k})$ or $s_{i'j'k} - s_{ijk} \ge p_{ik} - M(2 - x_{ijk} - x_{i'j'k})$. Constraint set (9) gives the definition of C_{max} which is to be minimized in the objective function (1). The non-negativity for C_{max} and s_{ijk} and binary restrictions for x_{ijk} and are specified in (10).

The stated problem is formulated using MIP algorithm. Since, problem is combinatorial in nature involving more than two machines and certain number of jobs that is NP-Hard, no exact solution for the stated problem is possible. In order to solve this problem, heuristic technique has been applied. An algorithm combining two evolutionary algorithms namely Neighborhood Search Method (NSM) and Genetic Algorithm has been proposed. Genetic Algorithms (GAs) are general search methods which are based natural evolution process. The proposed algorithm has been designated as Hybridized Improved Genetic Algorithm (HIGA) in this paper.

GAs are general search techniques based on the process of natural selection and genetics.First time this technique was introduce by Holland [7], GAs have been successfully applied to a large variety of optimization problems [7], Gen, Cheng [4], Goldberg [6]. GAs maintain and manipulate a population of feasible solutions i.e., chromosomes, but most of local search algorithms like Simulated Annealing (SA) and Tabu Search (TS) are based on manipulating one feasible solution, i.e., try to find best among the feasible solutions. A chromosome is made of genes which are responsible for its characteristics. These chromosomes are modified using genetic operators that mimic the principles of evolution and hereditary through which a new population is generated. The process is repeated until a specified termination condition is satisfied. Although GAs have proved to be a versatile and effective search technique for solving optimization problems, there are still many situations where the simple GA cannot perform. Thus, various strategies of hybridization have been suggested by Jog, Suh, Gucht [8], Ulder et al. [14]. These strategies usually incorporate conventional heuristics like SA or TS as a local improvement procedure with the basic GA. In this paper, a hybridized version of GA has been proposed, which combines GA with local neighborhood search method. It provides an extra add-on to GA. In the proposed method, local improvement procedure is applied to each newly generated offspring for moving it to a local optimum before inserting the offspring into the population. In this way, GAs are used to perform global exploration among a population, while local improvement procedures are used to perform local exploitation around newly generated chromosomes. Due to the complementary properties of GAs and local improvement procedures, an HIGA usually outperforms the either method operating alone. The general structure of the HIGA adopted in this paper is described as follows:

Step 1. **Initialization:** Generate an initial population of *psize* solutions.

Step 2. **Neighborhood Search:** Apply local neighborhood search and find local optimum solution.

Step 3. **Improvement:** Do improvement procedure by replacing each existing solution with a local optimum one.

Step 4. **Recombination:** Recombine the solutions in the existing population using genetic operators, crossover, and mutation, to generate next generation (offspring).

Step 5. **Neighborhood Search:** Apply the local neighborhood search and find local optimum in offspring.

Step 6. **Improvement:** Do improvement procedure by replacing each current offspring with a local optimum one.

Step 7. **Selection:** Select *psize* solutions from the solutions in the existing population and the new solutions generated in Step 4 to form the next generation.

Step 8. **Iteration:** Repeat Steps 4 to 7 until an optimum solution is obtained or the maximum number of generations, *mgen*, is reached, whichever is earlier.

Chromosome Design

While applying GA to the problem, design of an appropriate chromosome representation plays an important role with generic operator, so that it can produce better chromosome during the evolution process which will produce feasible solutions of the problem. In this paper, an operation-based chromosome representation is used for the open shop scheduling problem.

This representation encodes a solution as an ordered sequence of operations, where each *gene* stands for single operation. Further, operations are listed in the order in which they are scheduled. The chromosome in the first operation is scheduled first, the chromosome of second operation is scheduled second and so on. Each operation (unloading of inbound truck) under the schedule is allocated to the earliest available position on the corresponding out-bound truck. This process is repeated until all operations in the chromosomes are scheduled. It can be seen that the actual schedule generated in this technique guarantees the generation of an active schedule, where no operation can be processed earlier without delaying another operation.

Population

The initial population can be generated randomly. However, it is proved that seeding the initial population with a high-quality solution will help the HIGA algorithm to find better solutions quickly (global optimum). In this paper, one solution in the initial population is generated with the help of Shortest Processing Time (SPT) heuristic while the remaining solutions are generated by using the Thompson algorithm [5] for generating active schedules with ties broken randomly. Whenever during the execution of the Thompson algorithm a choice point is reached, where a next operation has to be selected, one of the schedulable operations is selected randomly.

Selection

The selection procedure in a GA determines which solutions in the current population are to be selected for recombination, and how the next population of solutions is to be generated. It directs a GA search toward promising regions in the search space. Many selection schemes have been proposed for various problems Giffer, Thompson [5]. In this paper, tournament selection scheme has been adopted.

Step 1. Select the best solution in the existing population and insert it directly to the new population (Elitist strategy).0

Step 2. Randomly select two different solutions from the current population with equal probability.

Step 3. Apply genetic operators, crossover and mutation to the two solutions, which results in two new child (offspring).

Step 4. Apply the local neighborhood search procedure to replace each child with a local optimum solution, which results in two new solutions.

Step 5. Put the two old solutions and the two new solutions together and select the better two with different makespans, if possible.

Step 6. Insert the two solutions selected in Step 5 into the next generation.

Step 7. Repeat Steps 2 to 6 until the next population is full.

In this selection scheme, the elitist strategy is used (Step 1) and inferior solutions are eliminated only through newborn superior solutions. Therefore, both the best and worst makespans of the solutions in the population at each generation are non-increasing. Initial tests show that this selection scheme significantly accelerates the convergence of the algorithm HIGA.

Crossover and mutation

Crossover operates on two parent solutions at a time and generates child (offspring) solutions by recombining both parent solutions' features. If ''good'' features of different solutions are properly combined, the offspring solutions generated may have even better features.

The crossover operator used in the algorithm HIGA is the linear order crossover (LOX). Several other crossover operators in initial tests including partially mapped crossover (PMX), order crossover (OX), cycle crossover (CX), order based crossover and position-based crossover have been tried in this problem, and it has been found that the crossover LOX works best for the problem under consideration. Crossover LOX, initially suggested by Falkenauer & Boufouix (1991)[3] and it works as follows:

Step 1. Select a subsequence of operations from one parent at random.

Step 2. Produce a proto-offspring by copying the subsequence into the corresponding positions of it.

Step 3. Delete the operations which are already in the subsequence from the second parent. The resulted sequence of operations contains the operations that the proto-offspring needs (This step will remove redundant solution).

Step 4. Place the operations into the unfixed positions of the proto-offspring from left to right according to the order of the sequence to produce an offspring.

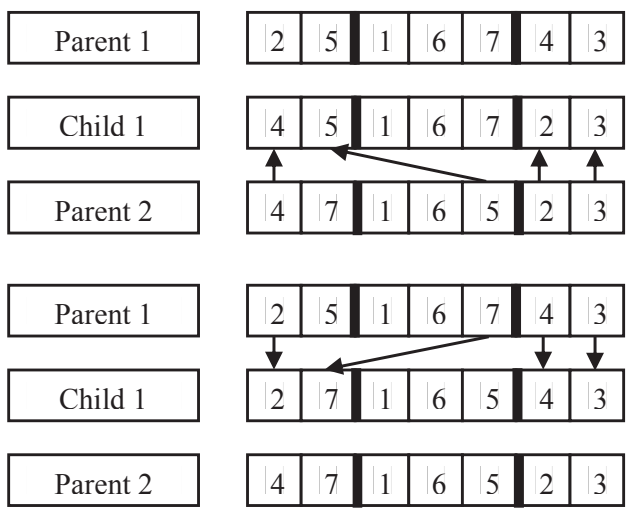

Figure-1 LOX operator

Computational results and discussion

$max_j\{\}$ where p_{ij} is the processing time of the operation which belongs to inbound truck *i* and has to be processed on out-bound truck *j*.

Another set of test problems consists of the benchmark problems presented by Taillard[13]. This set consists of five different problem types and 10 instances of

each problem type are solved for a total of 50 different problems. For each problem, the optimum makespan is mentioned if it is known. In absence of the optimum makespan, the lower bound value LB is provided. The parameters for the algorithm HIGA are set to the following values: population size (*pop_size*) 151, maximum number of generations (*mgen*) 120, crossover probability (p_c) 0.8, mutation probability (p_m) 0.2, and maximum number of iterations of the NSM procedure (*max_iter*) 120. The algorithm is coded in Cplex and run on a Core i-5 4GB RAM personal computer.

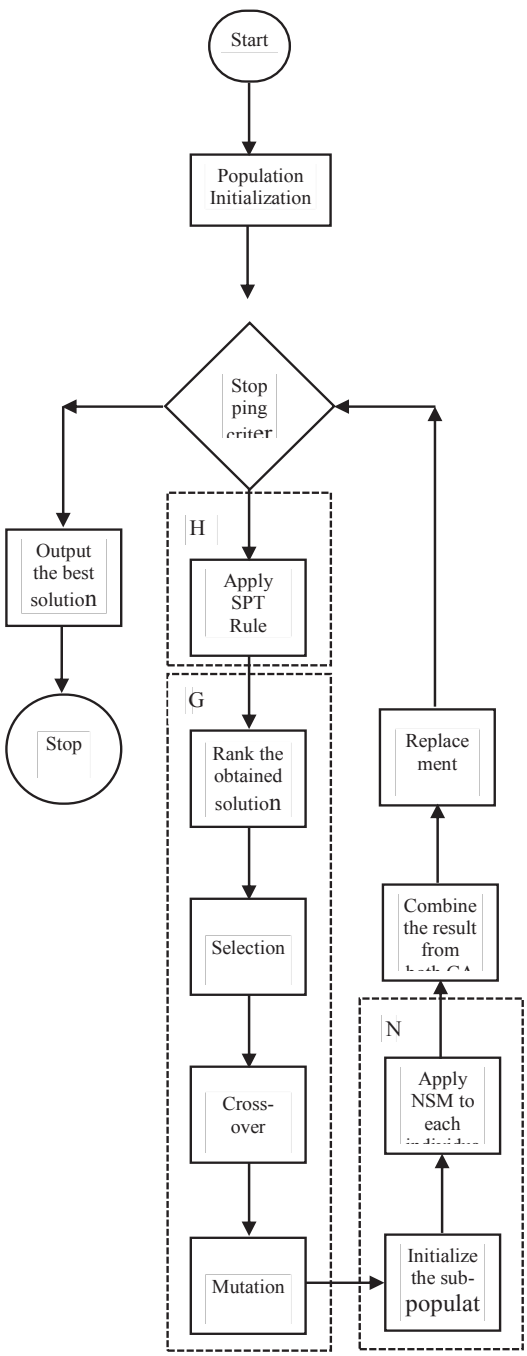

Figure-2 HIGA Flowchart

It has been found that except few of the larger size problems, all benchmark problem is solved and achieved the best known optimum solution. The proposed algorithm is capable to solve linear as well as non-linear problems but can generate solution very fast. In the above cited cases, problems are solved mostly in seconds.

Table-1 Result for Taillard's benchmark problems

Problem	LB	S_{HIGA}	S_{LPT}	S_{IH}	Time (Sec)
4x4_1	193	193	219	195	0.21
4x4_2	236	236	254	244	0.2
4x4_3	271	271	299	271	0.23
4x4_4	250	250	260	250	0.19
4x4_5	295	295	317	295	0.19
4x4_6	189	189	239	189	0.23
4x4_7	201	201	218	217	0.22
4x4_8	217	217	248	217	0.21
4x4_9	261	261	282	261	0.24
4x4_10	217	217	225	217	0.22
5x5_1	300	300	344	310	0.38
5x5_2	262	262	297	265	0.36
5x5_3	323	323	364	339	0.37
5x5_4	310	310	369	325	0.38
5x5_5	326	326	358	343	0.39
5x5_6	312	312	360	325	0.34
5x5_7	303	303	357	310	0.37
5x5_8	300	300	343	307	0.37
5x5_9	353	353	418	364	0.38
5x5_10	326	326	371	341	0.41
10x10_1	637	637	661	645	0.43
10x10_2	588	588	643	558	0.42
10x10_3	598	598	672	611	0.46
10x10_4	577	577	591	577	0.43
10x10_5	640	640	701	641	0.44
10x10_6	538	538	556	538	0.49
10x10_7	616	616	637	625	0.53
10x10_8	595	595	686	595	0.48
10x10_9	595	595	621	595	0.59
10x10_10	596	596	636	602	0.51
15x15_1	937	937	972	973	0.81
15x15_2	918	918	972	918	0.8

15x15_3	871	871	878	871	0.79
15x15_4	934	934	965	934	0.87
15x15_5	946	946	999	950	0.86
15x15_6	933	933	952	933	0.83
15x15_7	891	891	955	891	0.78
15x15_8	893	893	929	893	0.77
15x15_9	899	899	927	908	0.79
15x15_10	902	902	943	902	0.81
20x20_1	1155	1155	1200	1155	1.21
20x20_2	1241	1242*	1296	1244	1.57
20x20_3	1257	1257	1258	1257	1.54
20x20_4	1248	1248	1274	1248	1.48
20x20_5	1256	1256	1262	1256	1.56
20x20_6	1204	1209*	1215	1209	1.49
20x20_7	1294	1294	1317	1294	1.67
20x20_8	1169	1177*	1216	1173	1.24
20x20_9	1289	1291*	1293	1289	1.83
20x20_10	1241	1241	1265	1241	1.81

Conclusion

In this paper, HIGA incorporating a local search technique (Neighborhood Search Method) for solving cross-docking problem has been proposed. The incorporation of the local search technique enables the algorithm to perform genetic search over the search space of local optima. The algorithm is tested on randomly generated problems, and benchmark problems obtained from the available literature. Computational results show that the algorithm performs well and it outperforms the other existing methods relating to solution quality. GA is good at performing global search to escape from local optimum solution, while NSM is effective for conducting fine-tuning. By combining the properties of GA and NSM, the hybrid algorithm HIGA proposed is remarkably efficient for solving the cross-docking problem, which resembles with open shop scheduling problem. This algorithm finds an optimum solution for all within a reasonable amount of time (mostly in seconds). The future scope for research in this direction include the development of other efficient improvement procedures for local optima to improve the performance of the proposed algorithm. Further, the modification of the proposed algorithm may include other criteria like flow time, tardiness and some other realistic criteria like stochastic processing time instead of deterministic processing time etc.

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Paths-oriented Test Data Generation using Genetic Algorithm

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Abstract

Software testing is one of the most important issues in quality assurance of software products. In traditional testing methods, due to the complexity and high cost, full testing is impossible. The search-based approaches to software testing, as a solution for the automatic generation of test data are developing. In this paper, using a genetic algorithm, a method based on the execution path, for generation of test data, is presented. In the proposed approach, instead of checking the desirability of a generation for all paths, a fitness function is selected for each execution path. Thus, the fitness function for each path, identifies an appropriate generation with great precision and less time. Evaluation results show that the proposed method was able to increase the accuracy of the algorithms as well as reduce the generation steps and the process time.

Keywords

SBST, Path Oriented Testing, Genetic Algorithm, Test case generator

Introduction

Software development process includes important issues such as the choice of appropriate methodologies, requirements extraction, allocation of tasks and resources, generating code and the software testing. Due to the complexity and huge volume of tasks in software engineering processes, in the last two decades, AI techniques have been used in order to perform tasks more precisely. This approach is developing as a Search-based Software Engineering (SBSE) [1-3]. The search-based software engineering is a process of reaching a solution through representing the software engineering problems into the search-based problem by using meta-heuristic algorithms. Generally the results are close to the optimal solution [4]. The maturity of this approach can be observed by applying the recommender systems in the field of software engineering [5].

Software testing is one of the most important issues in the process of software engineering, which has an important role in the quality of the software. Test means the process of execution of the program in order to find possible errors, which is typically included about 50% of the cost of software development [6]. The objective of software testing is the generation of

minimum test data that should be able to traverse all or the greater part of the designed paths in order to ensure the validity of software. Therefore, achieving the proper way for generating appropriate test data, always is the problem for software manufacturers to reduce costs [7]. One of the fundamental approaches to generate test data is using artificial intelligence techniques.

Search-based software testing (SBST) is one of the most important search-based software engineering paradigms, which is for generating test data automatically. The main reasons for consideration this method, is the efficiency of this method in reaching the appropriate test data through a wide range of input data [8]. Using heuristic algorithms and meta-heuristic algorithms such as Genetic Algorithm (GA), Hill Climbing, Ant colony optimization, Tabu search and particle swarm optimization are the methods to find the appropriate solution in search-base software testing. However, until now no certain method found to reach the final optimal solution but usually using genetic algorithms and simulated annealing are the most common methods in this context [4].

Despite the various studies [9-11] to provide a suitable method for Exhaustive Testing is one of the major challenges in the search-based software testing. The covering of functional or non-functional requirements in test process, is an important feature of method to generate test data. In other words, a method for generating test data which can be able to test more software functionality is more desirable. In this paper, we proposed a test data generation method using a new approached of GA. Application of GA, providing the possibility of preparation a proper test data. The main characteristic of the proposed method, which is called execution path-based approach, is extraction of different execution paths and generating test data for each path. In other words, the proposed approach by providing a suitable framework of Genetic Algorithm, traverse the execution path in the software and generates the appropriate test data for different paths which as a result provided maximum coverage of functional and non-functional requirements of software. In this paper, the details of the genetic algorithms is neglected and the readers are referred to [12].

In the rest, first a review of literatures in the field of search-based software testing is presented. The proposed method will be explaining in Section 3. We present experimental results in Section 4 and present our conclusions in Section 5.

Related Works

Software testing is as an important tool in software engineering to ensure the quality of manufactured products. Black box testing and white box testing are two basic approaches in order to check the quality of software product [6, 13, 14]. In the black box testing, the details of the program execution flow will be ignored and the product functionalities are tested using a set of input and output. In the white-box testing, the internal structure of program execution is examined. In this method, the use of meta-heuristic algorithms to generate test data, consists of two main stage [13]. The first step is to extract the execution paths control flow graph (CFG) and then use these paths in an appropriate meta-heuristic algorithm, such as genetic algorithms, to generate test data. In search-based software engineering approach, most recent research focus on the use of meta-heuristic search techniques for the generation of test data and reduce the cost of software testing [15].

Maragathavalli used optimization search techniques and meta-heuristic algorithms to generate test data and compared GA-based testing and random testing [10]. *Mahal et al*. using activity diagram in UML and extracted the system graph model and then based on the time, cost and path coverage parameters, created optimization algorithm for generating test data [9]. The authors in [11], with study on the structure of a web application and extracting the different paths, generated test data using genetic algorithms. In [16], also for security testing and find the points and paths in vulnerable web pages, with analysis program and applying the GA, generation of test data is performed. The authors in [17] study the generation of data for the black box testing. The study used the GA and ant colony algorithm. The process of test data generation is done by deploying these two algorithms and results were compared with the greedy algorithm.

In search-based software engineering approach, the meta-heuristic algorithms are also used in the allocation of tasks and resources. For example, the authors in [18], proposed a method employed the requirements and available resources, in a GA and offered appropriate allocation of resources to tasks.

Li et al. [19] by introducing an objective function with multiple criteria, including the allocation of maximum resources, the proportion of maximum resources and tasks, and minimal overhead work, presented a resource allocation algorithm.

Proposed method

Various methods which presented in search-based software testing, generally are distinguished in the stage of algorithm selection and how to use path. One of the main problem in existing methods, is the lack of full coverage for testing paths. The main idea of the proposed method is the generation of test data for each execution path. The genetic algorithm is used as a meta-heuristic algorithm. This algorithm outputs the final generation as a set of optimized solutions, so the final generation of the algorithm can be used as a candidate for test data. In the proposed method, after extracting the execution paths, one genetic algorithm is constructed per paths and appropriate test data are generated. These genetic algorithms are executed in a parallel framework to reduce testing time of test data generation. The proposed method has two main advantages over existing methods. First, for each execution path a fitness function is selected. In other words, with the execution of a genetic algorithm for each path, define the appropriate fitness function for that path is provided. In addition, in existing methods, fitness functions evaluate the utility of each generation for all paths, however, in proposed method for each path, one generation (set of input data) will evaluate and the probability of selecting appropriate test data have been increased. Therefore, proposed method with reducing the repetition number of generation, besides increasing the accuracy of the algorithms, also reduced test data generation process time.

Identifying the path

In the proposed method, for every execution path, appropriate test data is generated so that the test data navigate the entire path. To identify the various execution path, the control flow graph (CFG) is generated. Then by moving from first node, all possible paths are identified. To identify appropriate data, paths are marked as end node in each path consider as target node. Any data that can reach by moving from start node to end node, selected as appropriate data. In other words, by applying one input data to the path, the execution will have ended to one path's nodes. The fitness function is calculated based on the distance between the ended node and the target.

Using paths on genetic algorithm

For each execution path extracted from the dominator tree graph, a genetic algorithm has been used. To reduce the time of test data generation, we create a framework for parallel execution of genetic algorithms. Thus, the algorithms set for all paths are executed in parallel mode. Application of genetic algorithms consist of chromosome structure definition, fitness function definition, the operations evolve, and repeat the generation production that is described in the rest. The proposed method is depicted in algorithm 1.

Chromosome structure

Genetic algorithms using fitness function to check desirability of any generation that contains a set of chromosomes and decides about selection of solution for answer. In search-based software testing, these chromosomes model the input. In the proposed method, an array of bits used for the construction of chromosomes. Thus each input data convert to a *k-bit* array and then by joining them into each other, a chromosome is constructed with length *n-bit*. In fact, every chromosome is a string of *n-bit* binary notation, that each *k* bits, respectively, from the left, is a candidate of test data. In the proposed method, a generation is chosen as the final solution if it is contained any chromosome that can navigate a path from start to target node.

Fitness function

In the proposed method, genetic algorithm runs per each path and the fitness function evaluate the utility of the generation based on the path. For each execution path, the fitness value is calculated based on the distance between the node which the execution is terminated and the target node. According to Equation 1, whatever the end node closer to target node, fitness function value is better.

Evolutionary operation

Evolutionary operation of genetic algorithms which contains generation and applying fitness function, is continued until it gets to the appropriate solution. The proposed method is also applied crossover and

mutation operators for a new generation. According to the structure of chromosomes, for *N* input, crossover operator is done with *N-1* break point. Mutation operation is done similarly on chromosome for next generation.

Tuning GA

The proposed method is applied to a number of classical programs like Triangle classifier and Midvalue finder. The following settings are used for GA in the proposed method after carrying out some preliminary experiments:

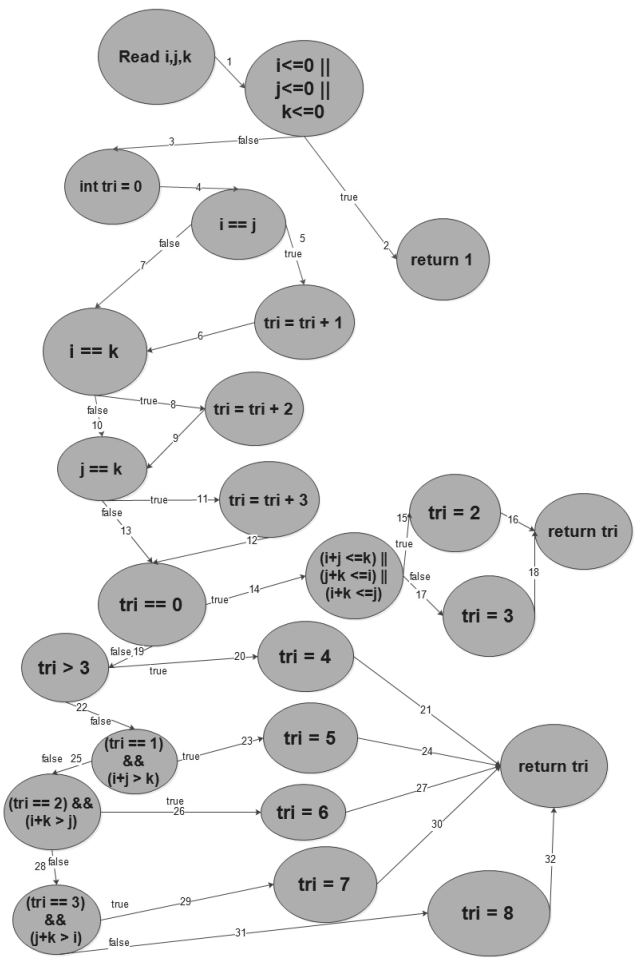
- Input variables are of type integer.
- Range = -16 – 49 (5 bits to represent each variable). The range of variables is different for Program #2.
- Population size = 25
- Selection mechanism: Tournament and elitism methods
- Probability of crossover = 0.6
- Probability of mutation = 0.2
- Maximum no. of generations for each run of GA (corresponding to the selected path) = 10^3

Experimental results

The proposed method has been evaluated on Triangle classifier and Midvalue Finder program which are two of the most famous benchmark program in the software testing [20, 21]. In the Triangle classifier, 8 paths are extracted and the chromosomes are selected with length 15 bits (5 bits for each input). Also, in the MidVal program, 6 paths are identified and the length of chromosomes is set to 9 bits (3 bits for each input). The CFG graph and code of the Triangle classifier and MidVal are depicted in Figure (1), Figure (2) and Figure (3) respectively. We first construct a parallel framework in the python to run concurrent GA for each paths. Then the GAs are implemented and the experimental results are produced. To compared the experimental results, a state of the art method is selected [20]. The comparison is done based on the runtime, the path coverage, and the number of generations. Table 1 shows the comparison results of the proposed method and existing methods. The results show that the proposed method is able to increase the accuracy of the test data generation in a shorter. Figure (4) and Figure (5) show the average run time for the 8 paths of Triangle classifier and 6 paths of MidVal per 100 times run, respectively.

Algorithm 1: Using GA to generate *test data*

1: **Input**: **D** = {execution paths}
2: **Output**: **O** = {test data for each path}
3: **Initialization:**
4: Assign path number for each path of **D**.
7: Create $\boldsymbol{generation}_0$ for each paths of **D,** randomly.
9: **for** i = 0 to *maxGeneration* **do**
16: Do in parallel for each $\boldsymbol{path}_d$ in **D:**
Calculate fitness for $\boldsymbol{generation}_i$ of $\boldsymbol{path}_d$.
17: **if** $\boldsymbol{path}_d$ is covered **then**
18: *Remove* $\boldsymbol{path}_d$ *from* **D.**
Add $\boldsymbol{generation}_i$ to **O** as a solution for $\boldsymbol{path}_d$
19: **end if**
10: **if D** is Empty () **then**
11: Break
12: **end if**
15: Create next generation for $\boldsymbol{path}_d$.
20: **end for**




```
def triangleclassification(i: object, j:
    object, k: object) -> object:

    if (i <= 0) | (j <= 0) | (k <= 0):
        return 1

    tri = 0
    if (i == j):
        tri += 1
    if (i == k):
        tri += 2
    if (j == k):
        tri = tri + 3
    if (tri == 0):
        if ((i + j <= k) | (j + k <= i)
        | (i + k <= j)):
            tri = 2
        else:
            tri = 3
        return tri
    if (tri > 3):
        tri = 4
    elif (tri == 1) & (i + j > k):
        tri = 5
    elif (tri == 2) & (i + k > j):
        tri = 6
    elif (tri == 3) & (j + k > i):
        tri = 7
    else:
        tri = 8

    return tri
```

Figure 1 - The code and CFG graph of Triangle program

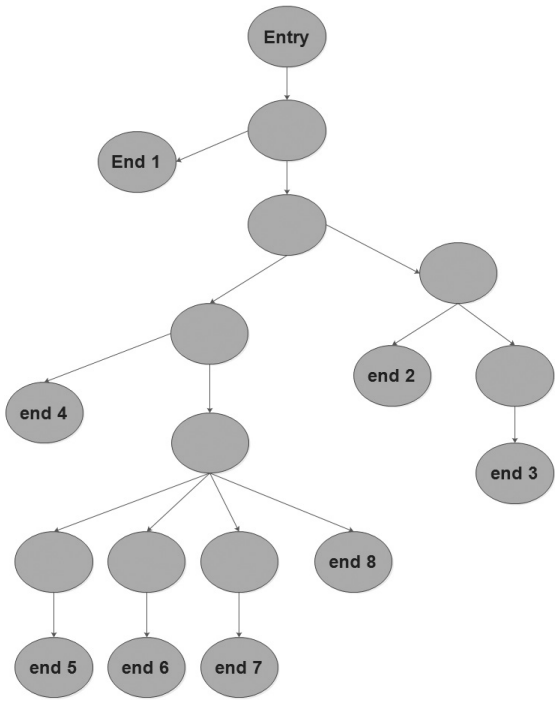


Figure 2 - The dominator tree Triangle program

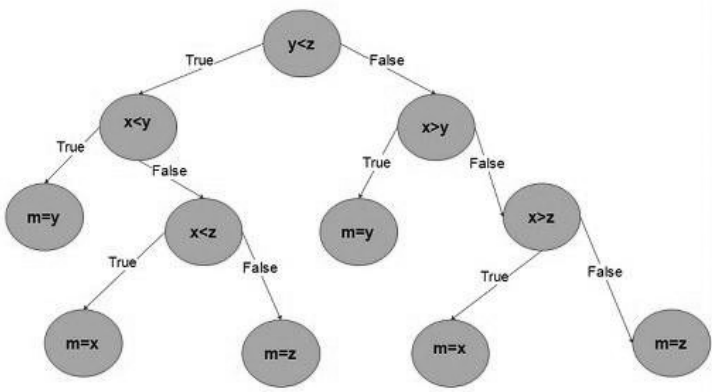


Figure 3 - The dominator tree of Midvale program

Table 1 - Triangle and MidVal programs comparison results							
Program		Proposed GA	GA by Varshney et al.	Random search	GA by Ghiduk et al.	GA by Girgis	GSO by Girgis et al.
Coverage (%)	Triangle	100%	100%	98%	100%	98%	98%
	MidVal	100%	100%	100%	100%	100%	100%
Mean no. of generations (Num.)	Triangle	22	27	478	265	378	309
	MidVal	3	5	17	9	13	7
Success rate (%)	Triangle	100%	100%	91%	100%	91%	96%
	MidVal	100%	100%	100%	100%	100%	100%

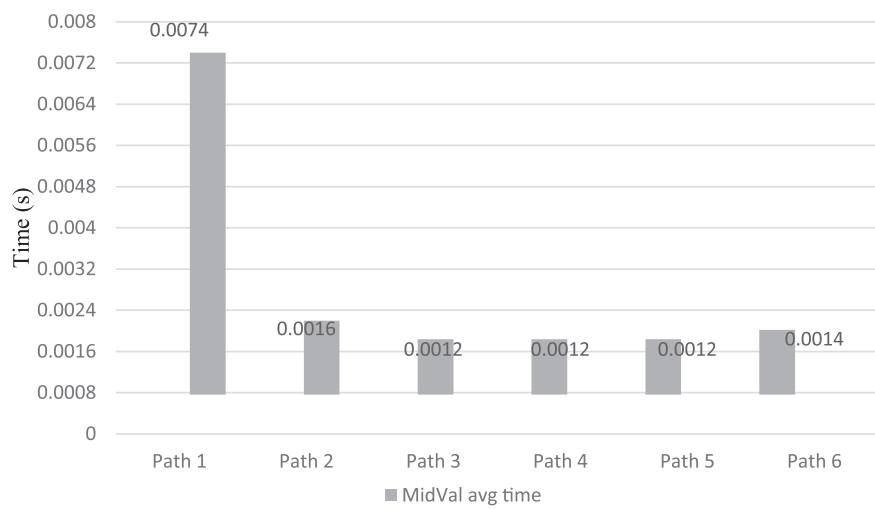


Figure 4 - Average run time for MidVal program per 100 runs

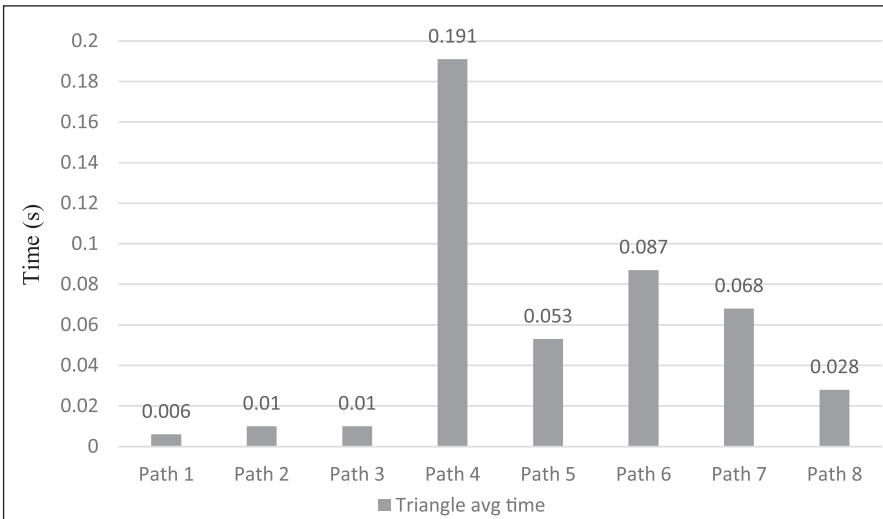


Figure 5 - Average run time for Triangle classifier program per 100 runs

Conclusion and Future work

a) Research in the field of SBST for automated test data generation is now relatively mature with an extensive body of work being available [21]. Evaluating the proposed method and comparing it with the two famous existing methods, shows that the path-oriented GAs are able to successfully reduce the average number of generations by keeping 100% coverage. In the future, the following items can be interested:

b) To perform the study on real and more complex programs with arrays and other data structure.

To make a new GA especially for test generation that run on multi paths at the same time and adapt chromosomes at the end of each generation from other paths that fit them better.

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The Survey and Future Evolution of Failure Transparency and Recovery Techniques

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Abstract

Failure transparency (FT) meanings that system is available to user when a problem is occur, the system still working without the user realizing it. FT is a measure that marks the availability of the system that normally works or works in a state of exception. Due to the emergence of different operating systems and Different platforms and need cover and fix errors in all forms In order to increase the reliability of systems absence a big blow to corporates credit, Need to do a review of the latest scientific achievements in this area has been accessed. Therefore in this article we have a solid understanding of the types of faults, and faults that led to failure, Techniques to prevent and recovery from failure.

Keywords: Software Failure, Failure Transparency, Recovery for failure, fault taxonomy, root cause of failure

Introduction

Now a days, because of the advent of various smart devices, we are faced with new forms of software Because of the increased diversity in the use of different operating systems, different programming platforms, as well as a variety of different software architectures. In all the millions of users of these systems and May reach billions of people, the reliability of the system is a major component of the system achievement and popularity. Since the occurrence of fault and failure is unavoidable, In order to maintain the reliability of systems, and reducing the amount of damage that a software company, and his people face, Strategies for treatment or prevention of failure stated that speak in the name of failure transparency.

In this paper we start with the definitions of a fault and failure, which are adapted from ISO/IEC/IEEE 24765 [3]. A failure is the inability if a system or component to perform its required functions within specified requirements, while a fault is an accidental condition or event, which if encountered, may cause the system or system component to fail to perform as

required. Faults can be introduced at any phase of the software life cycle and can be tied to any software artifact [2]. The terms bug, error, fails is typically used to refer to faults in the source code. For clarity, we just use the terms fault and failure.

The remainder of this paper is organized as follows. In section 2 we introduce the connotation of failure transparency, in section 3 we look deeper into some key issues and future directions of research in the area of failure transparency and recovery management and concludes with the paper.

The connotation of failure transparency

However, affect the failure transparency have been seen as an independent parameter, but in fact have many dependence to fault tolerance. Amount of fault tolerance, ability to identify fault and failure types, activities that are carried out after a fault event and the failure severity, fault localization and multiple handling fault all of the things that have been effective in prevention of failure and we are led to the recovery techniques.

Taxonomy

To classify each fault type, four fault taxonomies are used which are taken from Smith and Robson [4], Kung et al [5], Hayes [6], and Hayes et al [7] Hereafter these taxonomies are referred to as Smith92, Firesmith92, Hayes94, and Hayes11 respectively. They are all for general faults. Each of these taxonomies highlights a different type of program behavior: Smith92 emphasizes the difference between Conceptual inaccuracies, and implemented inaccuracies; Firesmith92 emphasizes consistency among visibility, components, and use of resources; Hayes94 utilizes general categories of software quality; and Hayes11 proposes a detailed hierarchy of faults based upon location, usage and intention [1].

[2] Explored trends in number of failures within individual releases (pre-release to Post- release) and across multiple releases (release n to n + 1) for a subset of Components, which had a sufficient number of nonconformance SCRs (software change request) and at least two Releases. Type of faults refer to the root causes of software failures. For each nonconformance SCR, project analysts select the fault type value from a pre-defined list. With the help of the project personnel and based on standard definitions from ISO/IEC/IEEE 24765 [8]. Some these major type values are requirement faults, design fault, coding fault, data problem, integration faults and other faults include types of faults that did not fit in any of the above categories, These was some we must know because that an Activity that was taking place when the fault was detected or the failure was exposed, may be different in each value type. Some activities that after fault or failure must be done are Inspections/audits, Analysis, Testing, On-orbit [2]. Other type of software faults (e.g., requirements faults, design faults, and integration Faults), detection activities, and failure severity were not explored in these works [9] [10] [11].

Variables, measures

The occurrence of failures in the software definitely related to different variables and some metrics used for them to measure the severity of failure that continuing to review them. [12] used to run time over head to verify that the execution of an instrumented application would not suffer an unreasonable penalty due to the instrumentation. Also measure the overhead in terms of total execution time and in terms of allocated memory in a normal (non-failing) run, and compare those measurements with the execution of the original application code, and initially assumed that the runtime overhead would be attributable to the checkpoint mechanism, since that is essentially the only active code executed in normal (non-failing) runs. Significant portion of the total overhead is instead due to the instrumentation alone, which in practice consists of the time needed to execute a try-block in the proxy method.

One parameter that may be useful is the number of recorded checkpoints, that may also shows that the checkpoint mechanism is quite efficient or not.

Another issue that must be consider is meantime between failures because of Existing measures for evaluating the performance of tracking algorithms are difficult to interpret, which makes it hard to identify the best approach for a particular situation. Characterizing the performance of algorithms is critical for determining which approach is best for a particular situation. Meantime between failures considered as a viable summary of solution quality especially when the goal is to follow objects for as long as possible [12]. A collection of measures such as precision, recall and multi-object tracking accuracy (MOTA) are derived from these base

statistics [14, 15]. These individual measures are somehow combined into a single score to enable direct comparison between algorithms, as well as searching for optimal parameter configurations through cross validation [16]. We propose a new evaluation technique which combines all of the tracking error sources into a single number that reflects the average amount of time a tracking algorithm can successfully follow an object without making a mistake: the mean time between failures (MTBF). The term is borrowed from the Field of reliability engineering [13].

Detection and localization techniques

Fault-localization interference is a phenomenon revealed in earlier studies of coverage-based fault localization that causes faults to obstruct, or interfere, with other faults' ability to be localized. In general, even in the presence of many faults, at least one fault was found by fault localization with similar effectiveness previously, it had been asserted that a fault localization technique's effectiveness was negatively correlated to the quantity of faults in the programs. Unfortunately debugging is often an arduous and time consuming task, requiring that before faults can be fixed, they first must be located, i.e., fault localization [1]. Techniques such coverage based fault localization (CFL) attempt to identify correlations between software failure and program locations. To investigate factors that influence CFL results, such as fault quantity in a program or fault Type Previous research's claims that CFL loses almost all effectiveness in the presence of multiple Faults. *Fault-localization interference* (FLI) occurs when a fault's ability to be localized decreases due to the presence of other faults. The main achievement of this part as (1) challenges and in many cases refutes commonly held beliefs regarding CFL effectiveness, (2) finds evidence of the factors that caused researchers to believe otherwise. Fault-localization interference is: (1) prevalent, (2) has a significant impact upon CFL results, and (3) rarely has the effect of impairing a CFL technique's ability to localize at least one fault. [1] Demonstrate that CFL techniques degrade roughly 2 % in effectiveness at high fault quantities. The main insight shared by these CFL techniques is that, execution events that correlate with failures are more likely to be the cause (i.e., fault or bug) of those failures said differently, execution events that occur mostly in failing test cases, but rarely in passing test cases, are more *suspicious* of being the fault. CFL analyzes dynamic correlations between instructions and the passing or failing of test cases. This correlation approximates the likelihood that an instruction causes failure [1].

Root causes of failure

Root Cause Analysis (RCA) is the process of identifying project issues, correcting them and taking preventive actions to avoid occurrences of such issues in the future. RCA also involves collecting valid data, analyzing it, deriving metrics and finding root causes using RCA methods [17] Root Cause Analysis (RCA) is the process to find out the causes of all deviations during the project life cycle [18] [19] [20] [21]. The RCA process should be facilitated by a senior member of the team and all the stakeholders should be involved of diagrams and figures to discuss all the data outside the control limits in data charts collected for the project [22]. Some of the most commonly used root caused analysis methods are:

Cause-effect analysis

The cause-effect analysis uses fishbone (Ishikawa) diagrams to illustrate how various causes can be linked to an identified effect. Events and Causal Factor Analysis Events and Causal Factor Analysis consists of the identification of a series of tasks and/or actions in a time sequence, as well as the environmental conditions of the tasks leading to an incident occurrence.

Fault tree analysis

FTA involves backward reasoning through successive refinements from general to specific. As a deductive methodology it examines preceding events leading to failure in a time-driven relational sequence. The resulting fault tree is a graphical representation of the potential combinations of failures that generated the incident. The tree starts with a 'top event' representing the analyzed incident and decomposes it into contributory events and their relationships until the root causes are identified.

Causal factor charting

CFC provides a structure for investigators to organize and analyze the information gathered during the investigation as a sequence diagram with logic tests that describe the events leading to the incident occurrence.

Brain storming

There are two main approaches to Brain Storming: Structured and in structured. Structured Brain Storming is where the facilitator asks each member of the group to contribute a suggestion or idea.

The 5 whys

The 5 whys is a question-asking technique used to find the cause and effect relationship to explain a particular problem. The main goal of this technique is to find root cause of a problem [17].

The major cause of software failures is the lack of effective software testing. Then according to [17] here are phase wise root causes analysis of software failures:

Root Cause Analysis of Project Planning, Requirements and Design Phase

Project planning, requirement and design are the primary phases that lay the foundation of the software product. If issues are not found and fixed early in these phases then the cost of fixing them later may increase exponentially.

Root Cause Analysis of development phase

In mature organizations and CMMI 5 companies; coding standards, guidelines, procedures are followed effectively, however in small and medium companies, this is a major issue. Each and every developer follows his own coding standard, which makes it hard to review and fix the bug and ultimately impacts the maintainability of the system one of the most challenging aspects for developers is unit testing of their own code. Developers consider their code as the best code in the world, so they only write for unit tests at a low level, rather than preparing unit test plans, cases, recording results and maintaining logs.

Root Cause Analysis of Software Testing and Implementation Phase

Also at this point of time, there is a diverse customer base working on various environments, which needs to be satisfied by built-in application to sustain in business. This ultimately makes it difficult to test the system for all possible conditions.

There are currently so many functional and performance testing tools, which makes that tool selection is difficult. There are various other traditional issues, which prevail in current industry.

More importantly, there is only one root cause of a failure, although it may have multiple manifestations. For example, if a failure occurred during integration testing and it was caused by a coding error, which in turn was due to missing requirement, the fault type would be classified as a requirements fault [2].

Recovery from failure

Even when detected and reported to developers, field failures may take a long time to diagnose and eliminate. The prevalence and longevity of faults in deployed applications may be due to the difficulty of reproducing failures in the development environment or more generally to the difficulty of diagnosing and eliminating faults at a cost and with a schedule. Among fault tolerance techniques, some address specific problems such as inconsistencies in data structures [23], [24], configuration incompatibilities [25], infinite loops [26], security violations [27], and non-deterministic failures [28], [29], while others are more general but require developers to manually write appropriate patches to address application-specific problems [30], [31].

In particular, this paper propose to exploit a form of redundancy that is intrinsic in modern component-based software systems The automatic selection and execution of a correct variant (to avoid a failure of a faulty one) is what we refer to as an automatic workaround. As for failure detection, our technique is almost completely independent of the particular detection and reporting mechanism. At a high-level, the technique works as follows: when a failure is detected, the state of the application is restored to a previous checkpoint, then the code of the application is dynamically changed to replace a chosen code fragment that contains a call to the library with a potential workaround, and then the execution is restarted from the checkpoint with that new code.

A bit more in detail, the technique consists of an off-line Preprocessing that also instruments the application with the Necessary machinery to apply workarounds at runtime. The preprocessor identifies (through static analysis) those sections of the application code in which the application calls the library in ways that could potentially be rewritten and in which failures may be detected We refer to those sections of application code as roll-

back areas (RBAs). The preprocessor then produces alternative versions of each RBA using all the applicable rewriting rules. Then compiled and stored for possible use at runtime. The preprocessor also instruments the application code by wrapping each RBA in a loop. The loop starts with a checkpoint of the state of the application, then proceeds with the execution of the RBA code, and then iterates in case of failures [12].

Summarize

Failure transparency, hide the failures, and the main condition for recognition of failure is Recognition system faults that are brought to the brink of failure. Failure transparency allows users and applications to complete their takes despite the failure of hardware or software components. Distributed systems is mainly due to component failure that may also be engaged other sectors are more susceptible to failure. As well as our main purpose in this article was summarizing and categorizing the latest studies and the future direction for the review of this important parameter.

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Fault Tolerance Mechanism and Recovery Approach

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Abstract

This paper describe diverse fault tolerance mechanism and express the connection between fault tolerance and two of the most important non-functional requirement. For avoid the fault we propose Preventive techniques and some Curative technique for cure the faults. In order to achieve the highest efficiency in fault tolerance mechanism we enumerate most of popular recovery technique in this paper and Based on our system characterized we choose one of them.

Keywords:

Fault tolerance, Error detection, Fault recovery, failure masking, non-functional requirement

Introduction

In this paper we discuss about type of software fault and we propose some method to prevent the fault, after that we introduce fault tolerance system and represent the non-functional requirement relation. In the following we express this mechanism to tolerate the faults and prevent the system to be failure and when a fault appear we propose some approach to solve this problem, based on system characteristics we can decide which approach is appropriate for our case.

Fault

A fault is any inherent weakness of system that leads to an error, An error is an incorrect or undefined system state that may lead to a failure, a failure Is a system deviation from its expected service which affected its intended functionality [2] , so it`s clear why we need a fault tolerance system. Generally failures occur as a result of hardware or software faults, human factors, malicious attacks, network congestion, server overload and other possibly

unknown causes. There are three different types of fault such as: transient, intermittent, and permanent fault which can occur in a system [1].

Transient fault: These occur once and then disappear. For example, a network message doesn't reach its destination but does when the message is retransmitted.

Intermittent fault: Intermittent faults are characterized by a fault occurring, then vanishing again, then reoccurring, then vanishing ... These can be the most annoying of component faults. It never goes away completely, unless it is resolved.

Permanent fault: This type of failure is persistent: it continues to exist until the faulty component is repaired or replaced.

Preventive techniques

This techniques known as fault avoidance. Fault avoidance is a process where we go through design and validation steps to ensure that the system avoids being faulty in the first place. In the first step this can include formal validation, c/ode inspection, testing, and using robust hardware. In the second step this techniques include all attempt to prevent failure by improving use of the resources to provide that same service in such a way that a failure does not affect the continuity of the service. This techniques for manage the resources use of sleeping strategy, the balance of energy consumption and the schedule of task.

Fault tolerance

Fault tolerance is the realization that we will always have faults in our system and that we have to design the system in such a way that it will be tolerant of those faults. That is, the system should compensate for the faults and continue to function. In designing a fault-tolerant system, we must realize that 100% fault tolerance can never be achieved. Moreover, the closer we try to get to 100%, the more costly our system will be. Fault tolerance as a new feature of a system requires additional overhead in both software and hardware. This area of research became visible in the early 60s [7]. Several attempts and efforts were done to explore ways how to design and classify fault tolerant system. Classification of measures that implement hardware fault tolerance were presented in [8].

The general approach to building fault tolerant systems is redundancy. Redundancy may be applied at several levels. Information redundancy seeks to provide fault tolerance through replicating or coding the data. For example, a Hamming code can provide extra bits in data to recover a certain ratio of failed bits. Sample uses of information redundancy are parity memory, ECC (Error Correcting Codes) memory, and ECC codes on data blocks. Time redundancy achieves fault tolerance by performing an operation several times. Timeouts and retransmissions in reliable point-to-point and group communication are examples of time redundancy [3]. This form of redundancy is useful in the presence of transient or intermittent faults. It is of no use with permanent faults. An example is TCP/IP's retransmission of packets. Structural redundancy deals with devices, not data. We add extra equipment to enable the system to tolerate the loss of some failed components. RAID disks and backup name servers are examples of physical redundancy. When addressing physical redundancy, we can differentiate redundancy from replication. With replication, we have several units operating concurrently and a voting (quorum) system to select the outcome. With redundancy, only one unit is functioning while the redundant units are standing by to fill in in case the unit ceases to work.

Availability

A complete fault tolerance model should provide a way to protect the state, detect fault as soon as possible and automatically recover consistent state in order to finish the execution. Availability refers to the amount of time that a system is functioning (available). It is typically expressed as a percentage that refers to the fraction of time that the system is available to users. A system that is available 99.999% of the time (referred to as "five nines") will, on average, experience at most 5.26 minutes of downtime per year. This includes planned (hardware and software upgrades) and unplanned (network outages, hardware failures, fires, power outages, earthquakes) downtime. The availability defined as the degree to which a system or component is operational and able to perform its designed function, is calculated as follows:

Availability= MTBF/ (MTBF+MTTR). (1)

Therefore a reduction in the Mean Time To Repair (MTTR) implies a higher availability even though

the Mean Time Between Failure (MTBF) of the system increases [4].

Reliability

Reliability is defined according to IEEE as the ability of a system or component to perform its required functions under stated conditions and for a specified period of time [5]. MTBF is a primary measure of system reliability which is defined as the probability that the system performs without deviations from agreed-upon behavior for a specific period of time. Reliability function= n (t)/N=failure free elements/ number of elements at time [6]. To enhance the reliability various service fault tolerance strategies are proposed. The major fault tolerance strategies can be divided into passive replication strategies and active replication strategies [9]. Passive strategies employ a primary service to process the request and invoke another alternative backup service when the primary service fail [10], while active strategies invoke all functionally equivalent services in parallel [11]. For example Recover block is a widely used passive fault tolerance strategy, while N-Version Programming is a well-known active fault tolerance strategy for reliability improvement. Some of the strategies are listed in blow:

1. Retry: Retry is a very simple and popular fault tolerance strategy, the software will be attempted to be invoked for one or more times when the original service invocation is unsuccessful.

2. Recovery Block: is another widely used fault tolerance strategy which contains a series of alternative that are to be executed in the listed order [12].

3. N-Version Programming: also known as a multi version software, is a method to generate multiple functionally equivalent programs from same initial specifications to improve software reliability [13].

4. Parallel: this is another active replication strategy. Parallel strategy invokes different replicas in parallel and takes the first properly-returned response as the final result. Compared to N-version programming, parallel strategy can obtain better response time performance.

Error detection

Error detection mechanisms form the basis of an error resilient system as any fault during operation needs to be detected first before the system can take a corrective action to tolerate it. A lot of error detection techniques are exist, where each of them has a different trade off in terms of energy, performance, area, coverage, complexity and programming effort, however there is no single technique that coverage all of the options. Detection mechanism can be classified in three different way: based on type of redundancy, placement in the system hierarchy, or detection coverage. Type of redundancy can be space-redundant, where hardware is replicated, or time-redundant, where software code is replicated. On the other hand, not all techniques utilize redundancy; thus, type of redundancy does not provide a comprehensive coverage of all available error detection mechanisms. Whether redundant or not, all techniques, however, are fully covered by a categorization based on placement in the system hierarchy or detection coverage. Placement of detection mechanisms can be at the circuit, architecture, software system, or application levels or involve a combination of these levels in a hybrid approach. Finally, these detection techniques cover hard, soft or both types of errors [14]. The main advantage of implementing error detection mechanisms in software is that it is not intrusive to the design and can be applied to most systems without modifying the underlying hardware structures. The most straightforward approaches in software have been replication and re-execution.

Curative technique

The technique belonging to this class are triggered when a fault happen. They attempt to recover the failure in order to resume the execution. The recovery is done by replacing failed component by new ones. Note, the replacement not means necessarily adding new component.

Recovery

Generally fault tolerance implies recovering from an error, which otherwise may lead to computational error or system failure. The main idea is to replace the erroneous state with a correct and stable state. There are two forms of error recovery mechanisms: forward and backward error recovery.

Forward Error Recovery

With Forward Error Recovery [15] mechanisms, an effort is made to bring the system to a new correct state from where it can continue to execute, without the need to repeat any previous computations. FER used when continued service is more important than immediate recovery. FER is a good strategy for later recovery and usually used in flight control operation. A good FER example is failure masking. Forward error recovery must be designed specifically for each system. This is a result of the dependence upon knowledge of the context in which an error occurs. Because of this, once a design is created, it can be very difficult to make changes to the design, particularly when new error types are introduced or when existing error types are altered.

Failure masking

Failure masking techniques provide fault tolerance by ensuring that services are available to clients despite failure of a worker, by means of a group of redundant and physically independent workers; in the event of failure of one or more members of the group, the services are still provided to clients by the surviving members of the group, often without the clients noticing any disruption. There are two masking techniques used to achieve failure masking: hierarchical group masking and flat group [17]. Flat group masking is symmetrical and does not have a single point of failure; the individual workers are hidden from the clients, appearing as a single worker. A voting process is used to select a worker in event of failure. In hierarchical group failure masking, a coordinator of the activities of the group decides within a group which worker may replace a failed worker in event of failure. This approach has a single point of failure; the ability to effectively mask failures depends on the semantic specifications implemented [18].

Rollback-recovery

Rollback-recovery consists of checkpoint, failure detection, and recovery/restart. A checkpoint is a snapshot of the state of the entire process at a particular point such that the process could be restarted from that point in the event that a subsequent failure is detected [16].

Rollback-recovery schemes can be categorized into 3 principal methods: tightly synchronized method (TSM), loosely synchronized method (LSM), and un-synchronized method (USM). The aim of this naming convention is to convey the degree of strictness by which a particular method forces the establishment of a checkpoint. Under the TSM, a processor can immediately force the establishment of a checkpoint by another processor at the point of an interaction between the 2 of them. Under the LSM, a processor can force the establishment of a checkpoint by another processor, but the establishment of that checkpoint need not occur at the point of an interaction between the 2 of them. In other words, the checkpoint can be postponed (by recording the inter-processor dependencies that arose at the checkpoint). Under the USM, a checkpoint by a processor occurs independently from all other processors in the system [19]. A good example for rollback-recovery is parallel system because (1) it allows computational problems that take days to execute, to be check pointed and restarted in event of failures; (2) it allows load balancing and for applications to be migrated to another system where computation can be resumed if an executing node fails; (3) it has lower implementation cost and lower electrical power consumption compared to hardware redundancy [20]. The major disadvantage is that rollback-recovery does not protect against design faults. After rollback, the system continues processing as it did previously. This will recover from a transient fault, but if the fault was caused by a design error, then the system will fail and recover endlessly, unless an alternate computational path is provided during the recovery phase. There are two major techniques, which are used to implement rollback-recovery: checkpoint-based rollback-recovery and log-based rollback-recovery.

Checkpoint-based rollback-recovery

The check pointing is to restore the last non faulty state of the failing task to recover from faults. The checkpoint is saved in advance into a stable storage and is restored with event of failures of a task. The rollback recovery is the most widely used means for system recovery in the occurrence of errors where the system executes as a succession of system states. In the event of occurrence of an error, the system rolls back to a previously reached state and resume execution from that state. The saved states are called checkpoints and the action is called check pointing or taking a checkpoint. This kind of system recovery

from a legitimate system state based on checkpoints is known as checkpoint based rollback recovery [21].

Log-based rollback recovery

Log-based rollback recovery uses check pointing and logging to enable processes to replay their execution after a failure beyond the most recent checkpoint. Log-based rollback recovery in general enables a system to recover beyond the most recent set of consistent checkpoints. As opposed to checkpoint-based rollback recovery, log-based rollback recovery makes explicit use of the fact that a process execution can be modeled as a sequence of deterministic state intervals, each starting with the execution of a nondeterministic event. Such an event can be the receipt of a message from another process or an event internal to the process. Sending a message, however, is not a nondeterministic event. Log-based rollback recovery assumes that all nondeterministic events can be identified and their corresponding determinants can be logged to stable storage. During failure-free operation, each process logs the determinants of all the nondeterministic events that it observes onto stable storage. Additionally, each process also takes checkpoints to reduce the extent of rollback during recovery. After a failure occurs, the failed processes recover by using the checkpoints and logged determinants to replay the corresponding nondeterministic events precisely as they occurred during the pre-failure execution. Because execution within each deterministic interval depends only on the sequence of nondeterministic events that preceded the interval's beginning, the pre-failure execution of a failed process can be reconstructed during recovery up to the first nondeterministic event whose determinant is not logged. Log-based rollback-recovery protocols have been traditionally called "message logging protocols." The association of nondeterministic events with messages is rooted in the earliest systems that proposed and implemented this style of recovery. These systems translated nondeterministic events into deterministic message receipt events. Log-based rollback-recovery protocols guarantee that upon recovery of all failed processes, the system does not contain any orphan process [22].

Summary

Fault tolerance is the property that enables a system to continue operating properly in the event of the failure of (or one or more faults within) some of its components. A fault-tolerant design enables a system to continue its intended operation, possibly at a reduced level, rather than failing completely, when some part of the system fails. We propose some approaches for avoid the faults and if some faults happen we describe recovery method for solve the fault problems.

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Flexible Working Arrangements: A Case Study of IT-SMEs in Thailand

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Abstract

This paper is part of the dissertation for an MSc in Project Management and Innovation of Strathclyde Business School The research aims at understanding how IT-SMEs (Small and Medium-sized Enterprises in Information Technology Business) implement and use Flexible Work Arrangements and Flexible Working Hours (FWH/FWA) in their organisations. In-depth interview data was collected from managers and business owners of 31 companies whose needs for Work-Life Balance varied.

Results show that many factors positively influence IT-SMEs to use FWH/FWA. For example, customers and partners working at different work-hours, traffic congestions between home and office, and the general stereotype of IT personnel. However, the results also found several concerning factors that may hamper the success of FWH/FWA implementation. They include the inadequacy of management skills in tracking, monitoring, and assessing employee's real performance, contextual factors for Thai IT-SMEs, i.e. conflict resolution culture, IT people's protocol of communication exchanges, and shortcoming of technology infrastructure. The findings also show that many companies that had used FWA eventually stopped. Thus, a four-phase cyclical framework called PLIC (Purpose-Limitation-Implementation-Consequence) has been developed as an approach to FWH/FWA implementation.

Key words:

Flexible Working Arrangements, Flexible Working Hours, Flexplace, Work-Life Balance, IT-SMEs in Thailand

Introduction

Flexible Work Arrangements (FWA) is part of the governing systems used by management during the industrial revolution and continues to grow in the information revolution and beyond. As Dr William Edwards Deming, well known for his work on quality and the Deming Cycle (Plan-Do-Check-Act), put it, "A manager of people needs to understand that all people are different. This is not ranking people. He needs to understand that the performance of anyone is governed largely by the system he works in, the responsibility of management" [15]. Thus, if the FWA system is implemented correctly, companies and all stakeholders involved should benefit. One of the most popular types of FWA is flexible working hours (FWH).

While companies from the industrial age still dominate the world, a new era has emerged. Companies are getting smaller but their economic values are greater. The previously known as Dot-coms have a new label called Tech start-ups which many are valued over $1 billion [49]. Regardless of what tags being given with the passing time, these companies are Information Technology (IT) companies, usually Small and Medium-sized Enterprises (SMEs). The question of whether IT-SMEs should all be using FWA is still debatable. More importantly, how to successfully implement a FWA system in IT-SMEs is yet to be explored.

The objective of the present research project is to investigate how FWA have been implemented in IT-SMEs. The main goal of this study is to come up with good practice recommendations for FWA implementation in IT-SMEs with the least possible retribution.

The limitations of the FWA usage will also be identified in the study result.

Findings from the study show different decisions made by owners of IT-SMEs in Thailand. Many of them chose to employ FWA extensively whereas others had terminated FWA privileges once given to employees. As a result, a straightforward implementation framework is proposed comprising four phases: Purpose, Limitation, Initiation, and Consequences. Each phase can be implemented independently without sequencing from one phase to another. By using the framework, companies can still benefit from their working process improvement.

Literature Review

This section first reviews the origin of working conditions, working hours in particular Then the pros and cons of FWA and FWH as well as how they are perceived by both employees and employers are summarized. Finally, reviews of FWH literature as related SMEs and IT companies are provided since IT-SMEs constitutes the data collection context of the present study.

The Origins of Working Hours

The beginning of working hours started during the industrial revolution. Everything was about efficiency and making sure that factories can operate as much as possible throughout the entire year. Back then, typical working hours can range from 10 to 16 hours per day [11]. In 1870, Maddison [40] reported that most countries had their people work over 2,900 hours per year. However, nowadays the number has plummeted to around 1,800-2,100 hours depending on the country, holidays, and vacation days allowed.

During a major part of the industrial revolution, there was hardly any law or dealt with workers or working conditions. But, towards the end of this era, Robert Owen, one of the founders of socialism, was among the first to consider a more humane way to treat employees. From his writings during the early 1800s, 'A New View of Society' and 'The Factory Reformer, Owen suggests that children should work less than adults [17]. This led to 'The Factory Act of 1833 in the UK which stated that children from age 9-13 should work 9 hours per day while age 13-19 should work 12 hours per day [51].

Today, regular working hours differ from company to company and country to country. However, for the working class, there is a well-known phrase, 'working 9 to 5' which means the working hours is from 0900 – 1700. This is translated into the notion that people should work eight hours a day. The root of an eight-hour working day can be traced back to Robert Owen in 1817. He was the one who coined the phrase "Eight hours labour, eight hours recreation, eight hours rest" [42]. Though Owen himself was unsuccessful with his slogan during his time, he inevitably gave birth to the eight-hour workday movements around the world. One of the first successful movements shown in history happened on April 21st, 1856 in the city of Melbourne, Victoria, Australia by Victorian stonemasons [28][42] and later, the eight-hour day monument was created in 1903.

Besides the number of hours per day, the 40-hour workweek has become a de facto standard when Henry Ford of Ford Motor Company made a strategic move to adopt the use of a 40-hour per week or 5-day workweek while his competitors were still using a 6-day workweek. Ford mentioned that by reducing of work-hours but maintaining the same wages, he had increased productivity [30]. While operational efficiency was the idea based on Frederick Winslow Taylor's 'Scientific Management' [50] that Ford had followed [45], Toyotaism focuses on making employee work efficiently to get 100% yields. Quality is more important than the quantity of working time. Thus, to increase productivity and remain competitive, companies can have machines work longer hours while humans work fewer hours [26].

Later, in 1938, President Franklin D. Roosevelt of the U.S. passed the 'Fair Labor Standards Act of 1938'. For the first time in the U.S. history, the regular work-hours for employees all over the country were eight hours a day and five days a week by law. Eventually, working eight hours a day and five days a week became the norm throughout the world. However, this model is understood differently by different cultures. For instance, the western world works from Monday to Friday, but most Islamic countries work from Sunday to Thursday. Another misinterpretation is how companies define 'eight hours of work'. Contradictory to the famous saying 'working 9 to 5', most companies exclude an hour of lunch break from the eight work-hours. So, in most places, employees need to stay at the company for

more than eight hours depending on the length of the lunch break set by that company.

Flexible working arrangements (FWA)

After the eight-hours work-day became the norm, employees have been demanding for FWA. However, as Gerdenitsch et al. [21] mentioned, there is significant ambiguity in what FWA means. Jeffrey Hill et at. [32] stated that from a company's point of view, FWA is "the ability of workers to make choices influencing when, where, and how long they engage in work-related tasks" Examples of FWA are, but not limited to, FWH, flexible working place (flexplace), compressed workweek, paid leave, job sharing, part-time, staggered hours, and annualised hours

Different studies reported the key benefits of using FWA differently. Nevertheless, one key advantage of FWA is the ability of employees to maintain good WLB [20][26][41] which results in less turnover, increase in employee productivity [18][21], lower absenteeism [56] and increase in employee satisfaction [55]. Another key benefit, mentioned by Kleinknecht et al. [33] and Kotey and Sharma [34], is that companies had fluctuated demands during the year and they need to find a solution to this unstable labour requirements. Hiring high or low skilled workers for the whole year would create unnecessary costs and managers would be unable to use them effectively. Thus, FWA is generally suitable for companies with uneven operations [2][39].

Galea et al. [20] suggested that some people consider FWA as extra benefits while others might consider FWA as a necessity to maintain their WLB. These includes individuals with responsibilities such as people with children, with disabilities, pregnant women, or with someone to take care of. People who work two jobs might need FWA in order to work around the conflicting schedules [12]. Also, concurrent-hour workforces may encounter difficulties to do basic errands such as buying food or going to the dentists unless they take a half-day or a full-day off. However, with the introduction of FWA, both employees and employers can deal with conflicting demands and responsibilities better.

In the past, the cost of arranging FWA structures was high and time-consuming. However, the ongoing advancement of technology has automated many things, such as recording employee's working schedule and performance evaluations, instead of doing them manually by managers.

From Kush and Stroh's [35] study, managers did not offer flexibility to their employees because they believed that businesses should not be run that way. Peper et al. [46] added that businesses with the 'image of top performers' and 'beliefs about real work' would be successful. Thus, a great deal of managers believed that being available to customers all the time and having fast reactions to crisis' instead of preventing them were the key success factors. Consequently, personal time of employees were sacrificed and customers might not receive the best services from those employees.

The push from society such as the need to create equality between men and women can also be factored into the adoption of FWA. Dex and Scheibl [16] and Peper et al. [46] believes that FWA can increase equality. Also, most European countries are shunning away from the model of the male breadwinner to an alternate model of women working part-time [8]. Companies that allow FWA can expect to benefit from a larger demographic pool of talent workers [6].

Laws, regulations, cultures, and traditions factor in the difference between FWA agreements from place to place. Boulin et al. [8] and Heinz [27] noted that if the law was weak, employees lifestyles would cost more than well-regulated markets. In 2007, the UK's first legislation of FWA came into effect and in June 2014, Nick Clegg, the deputy prime minister, enforced a new regulation that required companies to allow FWA to all employees who have worked with the company for over 26 weeks can request permission of FWA [1]. Now, companies can only refuse FWA requests based on only a number of reasons. [23].

As more businesses move to a global scale, company operations might need to be available at unusual hours and the use of FWH could help businesses save the costs of payment for working overtime [12]. In the present research, the FWA in focused is FWH or also known as flextime and flexitime.

Flexible working hours (FWH)

In 1967, a German company, Messerschmitt-Bölkow-Blohm (MBB), was the first to devise the plan of using FWH. This was a response to the low mo-

rale and low productivity of their employees. MBB and other companies used staggered hours to solve the problem of a long queue of time-clocking of their workers [7][54]. Staggered hours is what was considered to be the first step of implementing FWH because of the core similarities [29]. Loosely speaking, both FWH and staggered hours mean that companies have 'core hours' that every employee have to be present; only arrival and departing time are 'flexible hours' that they can choose to a certain extent [54]. FWH gives employees the ability to decide how and when to do the work. The power transfer from firm to employees is the key difference and is what makes FWH a powerful tool if firms are able to use it effectively.

Implementing flexible working hours in companies

The first step of implementing FWH is to decide why should the company do it. Cowley [12] stated that the context of the company is a key criterion to evaluate if the company could benefit from FWH. For instance, businesses like hospitals or department stores need to have fixed working hours to operate. On the other hand, sales-oriented business which operate around the availability of their clients would embrace irregular hours of employees. FWH will make all employees only available during 'core hours' which can cause communication problems [7][29]. Lee and DeVoe [38] stated that companies that adopt FWH with the goal of cutting costs could lower the overall profitability. Baltes et al. [3] commented that over time, employees would perceive FWH as the norm rather than an additional benefit for them.

Flexible working hours from the employer's point of view

Hill [29] concluded that the possible benefits to employers include: improvement in moral, reduction of sick leave and absence, reduction in overtime work, and lower turnover rates. In 1970, Lufthansa German Airlines implemented FWH and estimated that it lowered overtime during the peak demand months from 895 to 317 hours per month which lowered their annual expense by £500,000 [7] [54].

Kush and Stroh [35] reported that the possible impediments to FWA implementation include: more monitoring, employees abusing the system, and the cost and difficulty of system implementation. However, Cowley [12] suggests that managers need to look at the whole picture. Fewer turnovers can help the company maintain highly skilled workers who are more productive and costs less than replacing them. Adopting to these skilled personnel needs with FWA can help retain them [13][35].

Flexible working hours from the employee's point of view

Hill [29] stated that it is important to explain the FWA schemes to every employee to reduce jealousy. Without official regulations, employees might not feel welcome to use FWA if their peers are not using them [36] or they will feel that using FWA will penalise their career in the long [48]. Most blue collar employees cannot use FWA as effective as white collars. Hence, companies should find solutions that reduce the inequality between all employees in order to lower the resistance to change [54].

Small and medium-sized enterprises

SMEs have different definitions depending on which country and which organisation [44]. In Thailand, according to the revenue department of Thailand, the definition of SMEs varied by the industry it is in, producers, retails, wholesales, or services. However, in general, Thai SMEs can be defined as companies with less than 200 employees, less than 30-million-baht turnover, and less than 200 million baht assets.

Although most literature of FWA concentrates around large organisations [34][37], FWA research in SMEs should not be overlooked. In the UK, SMEs cover 99% of the number of businesses [24]. In Australia the number SMEs in the private sector went up to 99.7% which employed 70% of the total workforce [34]. SMEs provide a large share of the total workforces in the world especially in developing countries where SMEs provides up to two-thirds of the workforce. In low-income countries, the number could reach up to 80% [5]. In the case of Thailand, SMEs provide 73% of the number of jobs in the industrial sector [10].

In both private and public sectors, De Kok et al. [14] and Kotey and Sharma [34] found that FWH had been used in larger companies across most European countries. While smaller SMEs tend to be more flexible, larger organisations have more resources to support the flexibility of their WLB programs [10]

[37]. SMEs appears to use FWA as a mean to create competitive advantages which includes, trimming down employment redundancies during recession periods, and attracting high-performing prospects [19][34].

According to Foster's [19] research, both Laura Wilson, the HR support advisor from Loop Customer Management Ltd., and Dena McCallum, the owner of Eden McCallum Ltd., agreed that SMEs could easily embrace FWA because the communication line from senior management to employees are short. Wilson mentioned that adopting flexibility in a company was only possible if there was a similarity in work among her employees. McCallum said that it would be difficult to adapt FWA if all employees were doing different tasks because it might overburden the staff who had to cover the work of the ones using FWA. Each SME is relatively unique on its own. Thus, it is better to document 'good practices' of WLB programs across different firms instead of suggesting a one-size-fits-all approach [37]. Various good practices can then be modified to fit individual SMEs taste.

However, FWA is commonly given to employees on a case-by-case basis instead of to the whole class of employees [16]. As a result, obtaining the rights to use FWA could bring competition and negative long-term effects, for instance, Golden [22] found that employees who worked more than the others did, i.e., 50 hours per week, were more likely to gain the rights of using FWH. This promotes overworking and increase the likelihood of employees burning out.

Information technology companies

The definition of what considers being an IT company has changed in recent years. For example, EBay and Amazon were once known as IT companies during the Dotcom era because their businesses were done on the internet. However, in today's business, most companies have online transactions, which will be considered as IT company with the old definition [9]. For some, Uber is a major player in modern day transportation systems, and yet Uber considers itself as a 'technology platform' part of the 'sharing economy' companies. Airbnb also considers itself as a 'tech company' and with that categorisation, it was able to bypass regulations governing the hospitality sector for a lengthy period of time. According to Guzzetta [25], companies have branded themselves as 'tech companies' to gain benefits and to be more appealing to venture capitalists. Most of these self-claimed IT companies have levelled the competitor's playing ground by making large investment on their IT-based operations. Therefore, in the present research, an IT company will be defined as a company that uses technology and software to achieve competitive advantages.

In the IT world it is not hard to see companies overworking their employees which lead to the well-known phrase 'the 80-hour workweek' which became the ideal employee image of IT companies in Silicon Valley. Mostly these employees were young men without family commitments [31]. Ryan Sanders, the founder of BambooHR said that in one of his previous jobs, he was offered to work 80 hours per week and receive $400 Amazon gift card as an incentive [53]. Companies in scientific research and IT fields were more likely to provide FWA to their employees because skilled employees were more likely to receive FWA [34].

A study was done by Perlow [47] about a group of software engineers shown that traditional work practices such as working longer hours do not increase productivity. One of the main claims by Perlow is that employees need to work extended hours because they do not always do quality work. From her observation, the substandard work was caused by interruptions and asking for help from co-workers. Perlow then suggested the company to implement 'quiet time' and 'interaction time' policies. This type of arrangement was likely to improve the productivity of employees. This suggestion goes along with FWH practice which divides the working hours into two parts, 'core hours' and 'flexible hours'. During the flexible hours, employees can clear their individual work without any disturbance while core hours can be used to coordinate the work within the team. However, for this method to be successful, the company needs to reward their employees by the quality of work and not by the amount of time spent on the work itself. Likewise, Behson [4] states that most companies want to evaluate employees by their performance, but by doing so, it would put an enormous burden on the manager who has to do a thorough evaluation of the work which is significantly harder than measuring 'time at work'.

Research method

Data collection

In several FWH studies, questionnaires and interviews were widely used. In the present study, telephone interviews using VOIP technology were conducted using Facebook Call, Line Call, Google Hangouts, Skype, and Cisco WebEx. Although most VOIP programs support video call which could combine advantages of face-to-face and telephone interviews [43], the researcher chose not to use the feature to make interviewees more likely to feel in control and less stressful during the interview because they will not have the face-to-face pressure.

Although it is hard to obtain an adequate number of samples even though the researcher is familiar with IT-SMEs[1]. Therefore, a convenient sampling with snowball technique was used for sample selection. Nevertheless, to generalise the findings, the collected data should represent a variety of FWH practices. Thus, all participants in this research were deliberately chosen from different companies so that they can provide as many FWH practices as possible but still address cultural context, all samples are IT-SMEs from Thailand.

To acquire perspectives from different types of participants, the present study classified the subjects based on marital status used in most literature about WLB [52], including Single (S), Married with no dependents (M), and Having Children (C). Also, to enable more generalisation in the findings without overlapping practices, participants were categorised into three roles: employee, manager, and owner. Owners (O) of SMEs are the person with authority who set up the rules and regulations of the company. Managers (M) (who are not owners) can give a valid viewpoint of how the work-hours affect the work of employees and suggest other practices of working around the firm regulations without bias. Employees (E) are the people who receive the most impact from FWH/FWA. In order to report the interview results, the study uses pseudonyms to anonymise the interviewees. For example, 14MSO will represent the 14th interviewee who is male, single, and is the owner of the company.

Sample

A total of 31 individuals from different companies participated in the research. Table 1 shows the profile of respondents. The majority of interviewees are single (68%). Males respondents doubled the number of Female respondents (68% to 32%). There are slightly more owners/managers being interviewed than employees, 55% to 45% respectively. Note that by using snowballing technique, the majority of participants was either employees or owners of similar ages as that of the researcher. Managers who were not owners were hard to find, because most owners of SMEs take on management role themselves. These selection biases are traded off with the research design to obtain the maximum diversity of organisation contexts – one participant from one company.

Table 1 – Profile of Interviewees

Respondent Profile	Type	Number (%)
Gender	Male Female	21 (68%) 10 (32%)
Role/Position	Employee (E) Manager (M) Owner (O)	14 (45%) 4 (13%) 13 (42%)
Marital Status	Single (S) Married (M) Have Children (C)	21 (68%) 4 (13%) 6 (19%)

Table 2 shows the profile of the respondent's companies. Over half of these firms (56%) have at most twenty employees. Almost half (48%) are quite young (0-5 years old). Twenty firms (65%) have used FWH and seven (22%) had used but revert back to fixed-hours. Thirteen of the IT-SMEs (41%) in this research have used other types of FWA which are flexplace, compressed workweek, and staggered hours. Note that 'Weekend work' signifies that there is a possibility for employees to work on the weekend which can be from employees catching up on their normal workload or employees working extra upon company's requests. Only one company had mandatory work-hour on Saturday for one day per month.

1 At that time, the researcher was studying in Glasgow, Scotland

Table 2 – Profile of Thai IT-SME Samples

Company Profile	Type	Number (%)
Size (number of employees)	1-20 21-50 51-100 Over 100 Unidentified	17 (56%) 8 (26%) 2 (6%) 3 (9%) 1 (3%)
Age of company (approximate years)	Less than 2 3-5 6-10 Over 10 Unidentified	7 (22%) 8 (26%) 5 (16%) 6 (20%) 5 (16%)
FWH usage	Officially regulated Not regulated but used Reversed back to FWH No regular working hrs	8 (26%) 12 (39%) 7 (22%) 4 (13%)
Weekend work	Saturday only Saturday and Sunday No weekend work	5 (16%) 13 (42%) 13 (42%)
Compensation for working over the normal work-hours	Time only Money only Time and money No compensation	12 (39%) 7 (22%) 3 (10%) 9 (29%)
Other types of allowable FWA	Flexplace Compressed workweek Staggered hours	10 (32%) 2 (6%) 1 (3%)

Result

Results from interview responses are grouped into five distinctive themes. First is to assess the participants' understanding of FWA. Second is to identify the problems that are caused by the implementation of FWH. Third is to explain the context of companies in Thailand. Forth is to elaborate on how companies should approach the use of FWA. Fifth and the final theme is the suggested course of actions from both employer and employee sides.

Understanding of fwa, fwh, flexplace, and compressed workweek

The findings show that although FWH can be differentiated from other types of FWA, all of the FWA practices are more closely tied than expected. Most respondents combined the definitions together and used the terms; flexibility, FWA, FWH, flexplace, and compressed workweek interchangeably.

From the literature review, **FWA** was mostly created to accommodate individuals who have burden and responsibilities such as those with old parents or children. Some said 'Flexible is not flexible if you cannot work from home'. They mentioned that it does not make any sense for parents to go back to finished their eight-hour workload at the office after sending their children home (3MCO, 16MSE). Having the ability to work on an idea whenever it pops up is critical to jobs like programming because it is not a routine kind of work (25MSE, 28MSE, 31FCO).

The understanding of advantages and disadvantages of FWA and FWH varies widely among different types of participants. Thus, there is unlikely to be one-size-fits all policy of **flexplace**. One owner found conflicting views of flexibility as defined by managers and their subordinates (31FCO). However, interviewees agreed that face-to-face working is easier than remote working (11MSO, 25MSE). The proponents of non-flexplace indicated that face-to-face workplace can hasten the communication by the use of pencil and paper (18MSE) and fix problems faster by looking at each other's monitors instead of using team viewer programs (18MSE, 22MME). Without human interaction, communication can be dry (17MSE); working alone will lack the social aspect of life (25MSE); and communication will be slowed (22MME, 24MSE) or lost (16MSE). Furthermore, flexplace does not appeal to people who want to completely separate work from leisure (17MSE).

FWA limitations generally come from the company's customers. For instances, programmers and software houses can utilize compressed workweek because they do not need to face customers (5MSO, 25MSE). Companies which core business works closely with client cannot have that much flexibility in working as they have to follow the rules and schedules of their clients. Since their customers work five days a week, so should they (26FSO, 30MMO). Competing with the fast rate of change from competitors is why one company does not support the idea of only working four days a week (5MSO). (20FCO) believes that work can be done anywhere and supports the idea of flexplace, but the company requests employees to standby at the office so as to contact them easier and in the case of surprised and emergency visits or calls from their customers.

Other reasons why employees do not utilise flexplace is the complexity of remote work which causes nuances such as slow network connection (24MSE). This is true if the nature of work deals heavily with hardware (28MSE) that obliges employees to work in the office. Likewise, flexplace is not applicable during the phase of the project which requires heavy coordination (27MSE).

In terms of **FWH**, there is a debate on the number of working hours per day an individual should do. A group of interviewees felt that people should not work continuously for a long period of time. Any working time more than normal will result in drawbacks such as: drastic reduction in productivity (3MCO, 14MSO, 16MSE, 24MSE), loss of concentration (17MSE, 29FSE), cause of sickness and employees using sick leaves (15FSO), and perhaps negative effect on time management (24MSE). The consequence of this argument leads to a disapproval of the idea of a compressed workweek.

On the other hand, some interviewees support the idea of working longer hours per day and they mostly agree that compressed workweek should benefit the company as well as the employees. When employees are 'in the zone' they have high productivity and by expanding the working day, their peak periods will expand as well (22MME, 27MSE). In addition, with longer weekends, they can also rejuvenate themselves more effectively (27MSE).

Another idea was to eradicate working hours completely if they are IT workers who do not need to work face-to-face with customers (26FSO) and measure them by performance instead. IT workers are not blue collar workers so they should not be evaluated by the time they spend doing the work (28MSE) but by productivity (13FCM). A number of interviewees mentioned that they frequently worked more than eight hours a day so compressed workweek did not make sense from the beginning (2FSE, 5MSO, 28MSE).

Instead of managing people by working hours, the Scrum methodology manages people by 'Story Points' and helps people track's each other progresses. Eventually, the working hours will be restricted by their co-workers and customers (17MSE, 19MME). Furthermore, monitoring working hours FWH is hard and burdensome (5MSO, 13FCM, 28MSE). Measuring and recording time stamps can also exert pressure on employees (6MSM, 28MSE).

Problems of FWH

FWH will cause problems to managerial staff (2FSE) because employees can arrive and leave at different times. This can be a burden to schedule meetings (1MSM, 7FSE, 8FCO). By curving on flexibility, meeting arrangements are much easier (14MSO). One company supported the idea of FWH but the nature of IT employees of arriving late caused the managing director to be worried (28MSE). Using fixed-hours can assure that there will be somebody to do the work if a customer contacts the company at certain working hours (21MMO, 28MSE). The time for day-to-day interaction within the team will be less leading to worse communications (9MSM, 17MSE) and a feeling like the company is fragmented and not unified (7FSE, 15FSO). Work might get delayed because the need to wait for employees who arrive at later hours (18MSE).

With the freedom of FWH, employees can get confused on non-essential details such as when they should go home (3MSE), when they should wake up, and where they might separate work from personal life (6MSM) – these appears to distract them from doing the actual work (11MCO).

Bad management can result in companies abusing employees from FWH implementation. Companies in Thailand use the term 'flextime' to exploit employees over regular working hours (2FSE, 6MSM) such as being asked to work during the weekends or fixing a program bug at home at non-working hours, both incidents without any compensation or as the owners of both companies considered it to be part of the 'flextime'. Another incident cause (6MSM) to work without breaks for two months but couldn't utilise the day's off gained within the time limit, working free for five days. But, later on, the company fixed this issue by giving employees the choice to choose between money or time compensation.

From a management standpoint, employees might abuse the company if the tracking system is poorly executed (24MSE). Then again, employees need to prove that they deserve the given flexibility by showing better productivity (23FSE). Managers who plan well enough can make FWH free of negative consequences (27MSE). The scope of work for each employee needs to be clear to enable employees to

use FWA (10MSO, 18MSE). Monitoring tasks, such as following up and rechecking work are necessary skills for managers (20FCO). Otherwise, employees might leech of the team's good performance (19MME).

The problem of jealousy among co-workers for not being treated equally was found across many companies (5MSO, 10MSO, 11MCO, 14MSO, 26FSO). (5MSO) had repeatedly been asked by his employees as to why some of his co-workers could use flexplace whereas the others could not. Many agreed that FWH could increase productivity. Nevertheless, they ended up with having to set a policy for everyone using the same set of rules regarding working hours (11MCO, 14MSO, 26FSO, 30MMO) so as to avoid jealousy projected by other teams or departments. However, most companies only allow good performing employees to use FWA and these people were only given FWA if they request on a case-by-case basis (21MMO, 26FSO, 31FCO). It was suggested that to avoid jealousy caused by different standards; the company needs to be clear about their policy of FWH (23FSE). Yet, it was suggested that the inequity can push employees to work harder to receive FWA privileges (31FCO). But it was also agreed that if the manager is not well skilled enough, it is better to omit the use of FWA (26FSO, 31FCO).

1. Fwa and fwh in thailand context

Thai culture

Most literature supporting FWA is based on western cultures. For Thailand, many interviewees agreed that the working culture of Thai people do not support FWA (8FCO, 10MSO, 15FSO, 31FCO). Nonetheless, (15FSO) believed that the main reason why the Thais should work with fixed-hours systems is because of the deep-rooted cultural and social interaction manner called 'Grengjai' (Thai term). Thais consider it rude to express their true feelings upfront so they accumulate negative emotions until the breaking point as they should be 'Grengjai' to others. To avoid 'Grengjai', managers should work closely with their subordinates to observe any subtle emotions. Also, the Thais are not goal oriented (5MSO). They have the tendency not to fully work during working hours (3MCO). It is common for Thais to use Facebook, Line, YouTube, and answer phone calls for non-work related issues during working hours (3MCO, 5MSO).

Traffic issue

Many interviewees agreed that implementing flexplace can reduce time wasted in traffic (19MME, 29FSE, 31FCO). Using public transportation such as the sky and underground train is not comfortable nor easy as you need to squish yourself into those trains (3MCO, 7FSE). All participants unanimously agreed that traffic in Bangkok is bad, and the major benefit from having FWH is to avoid rush hours (2FSE, 23FSE). Another company changed from fixed-hours to FWH because the traffic in Bangkok had gotten worse over time (9MSM). Some employees will stay in the office after working hours without doing any work just to avoid traffic (28MSE). Traffic and commute time is also the main reason why companies give good performing employees the ability to request for flexplace (16MSE).

One interviewee (16MSE) said "… it's very convenient because I could avoid the traffic hours. Like, I could come early and leave late. And some days I could leave early to avoid the traffic. That saves me a lot of time. It's very important in Bangkok because the traffic will be really bad. Going back at one time might take one hour, but if I go in the rush hours it might take two to three hours." In other companies (2FSE, 24MSE, 29FSE), commuting time to the office for employees typically take 2-4 hours per day which is why flexplace can be useful. However, travelling time in Bangkok cannot be determined accurately (4MSE). "Everyone knows that in Bangkok it is really hard to control the travelling time or to make sure one would arrive on time" (25MSE). With FWH, employees can feel relieved from the pressure and stress to arrive on time (9MSM, 17MSE, 18MSE). Some interesting non-traditional practices that were used to avoid traffic include having working hours from 1200-2100 (5MSO) and renting rooms in hostels nearby if early meetings were scheduled (10MSO).

2. Using flexibility appropriately

Employees who have families need FWA to maintain WLB (24MSE). Some employees apply for companies that allow them to utilise FWA because they have dependents (12MCO). Below average employees can increase their performance by working more hours (1MSM) while talented employees can have more free time if they finished their work early (26FSO). Other common **benefits** are mentioned in

Table 3 – Benefits of FWH commonly cited

Benefits …	Cited by Interviewee(s)
… feel less restricted and relaxed	7FSE, 20FCO, 27MSE
… enjoying more freedom in life	14MSE, 23FSE
… feel more productive	16MSE, 21MMO
… work at comfortable and productive times – early in the morning or late at night	3MCO, 4MSE, 22MME, 24MSE, 28MSE
… can be more creative and logical as ideas and inventiveness may not come at fixed-hours	1MSM, 2FSE, 3MCO, 13FCM, 23FSE, 27MSE, 31FCO
… focus on work not work-hours	21MMO, 25MSE
… can rebalance workload	26FSO
… trained to be more responsible	21MMO
… won't get bothered by office nuisances such as 'tapping on the shoulder' by creating 'quiet time'	1MSM, 10MSO, 22MME, 27MSE, 29FSE

From the company's perspective, allowing FWH would enable employees to coordinate their work easier with international partners (16MSE) or clients that work at irregular hours (20FCO). If companies utilise flexplace effectively, there will be no need to have an office to begin with (14MSO, 28MSE, 31FCO).

FWA and FWH should be used with some **cautions**. Employee factors that make FWH hard to implement are: new hires (13FCM, 20FCO, 21MMO), graduates (26FSO, 30MMO, 31FCO), employees without self-autonomy (6MSM, 23FSE, 31FCO), and irresponsible employees (19MME, 21MMO, 27MSE). Thus, effective management systems are needed to keep bad employees from unacceptable behaviours (29FSE). Sufficient technology should also allow more FWA for employees (5MSO, 11MSO, 13FCM, 16MSE, 19MME) which could reach to a point that the company doesn't need an office (28MSE). Cloud repositories could enable employees to work at home (19MME). Laptops with virtual private networks installed should be available for all employees who want to go home early (16MSE).

Implementing FWH in IT companies in general should not be a problem (22MME). Nevertheless, company's characteristics have some bearing on the implementation (5MSO, 12MCO). FWH can be applied mostly to software houses (22MME), start-ups (21MMO), and creative companies (27MSE). This opinion was not shared by other participants who suggested that FWH would have negative effects on communications within small companies but might not do much harm to large ones (11MSO, 17MSE). FWH can also make it harder for businesses to find appropriate coordinating times with their clients (21MMO, 30MMO). In some cases, it depends on the phase of the project (12MCO, 27MSE). During the phases that involve heavy customer engagements, firms should abstain using FWH (12MCO).

Suggested course of actions

Understanding the nature of the company and its employees is what managers need to think before considering any type of flexibility (1MSM, 3MCO, 10MSO, 18MSE, 27MSE, 29FSE). Most people do not like changes (25MSE) so managers and employees need to work together to find solutions. During the transition, companies should set up regulations (7FSE, 8FCO, 10MSO, 22MME, 25MSE) and resolve conflicts (14MSO, 21MMO) in order to make employees as happy as possible (25MSE). Using peer-pressure to keep employees in order could be a creative solution to avoid conflict (29FSE, 30MMO). The policy of the company needs to be clear to avoid jealousy (4MSE, 16MSE). Issues like how the company deals with compensation for overtime work or working at unusual hours (4MSE, 7FSE, 8FCO, 10MSO) must be addressed.

Managers need to know how to delegate, track, and evaluate people by using target/goal and results instead of working hours (5MSO, 10MSO, 12MCO, 15FSO, 16MSE, 26FSO, 29FSE, 31FCO). If the managers are not capable or do not have the means to monitor and manage FWA's related activities, companies should not allow FWA to be used at all (29FSE, 30MMO, 31FCO). Nonetheless, the business unit should remain working without much flexibility (12MCO, 31FCO).

Together with FWA implementation, 'Quiet time' should be focused to allow employees to work without getting bothered and to be 'in the zone' of getting to excel execution at peak performance (10MSO, 17MSE, 22MME). This is because not all questions need an answer immediately and 'asynchronous communications' (22MME) can be effective too. Besides, employees need to find people to cover their work if they choose to arrive at later hours (22MME). Trust all-around is crucial for the success of FWA. As one employee put it, if firms do not trust

their employees, supervisors do not have faith on subordinates, or co-workers cannot rely on one another, the FWA will fail (29FSE).

Most participants suggested that the implementation should start in small scale as a pilot study, testing with one department at a time (9MSM) or with a small group of employees (21MMO). Testing on a low-risk-low-reward project in case things go wrong (19MME). A mediator needs to be appointed to evaluate how the change affects the overall productivity of the company and what the next move should be (9MSM, 14MSO, 19MME, 21MMO). One interviewee added that to make the change possible, all employees need to try out the FWA in order to get a better understanding (29FSE).

In the end, there should be a limitation. For instance, FWH should start by giving one flexible hour at first (14MSO), then move the hours up slowly, but end up setting the limit to around 2-4 flexible hours so as to have the adequate amount of core time available (3MCO, 17MSE). One specific suggestion of suitable time for IT companies to start their core working hours is at 1100 (3MCO, 17MSE). If employees tend to arrive late, moving up working hours could offset the problem (8FCO).

Small sized companies can perhaps implement FWH company-wide immediately because the owner is able to oversee the whole company with ease (24MSE). Nonetheless, even with a limited testing size of the study, a good representative should be created by mixing the high, medium, and low performing employees together (19MME). Finally, organisations need to prepare for constant changes during their growth period. It is common for a company to change its organisational structure and policies when the number of employees reaches certain thresholds (5MSO).

Discussion

In this study, the research questions were based on the idea that FWH can be easily identified, simplistically separated from other FWA, and viably implemented across organisational settings. Although the definition of FWH can clearly be defined, the present findings from IT-SMEs in Thailand show that it cannot be separated from other FWA. Since findings from the result section is somewhat sporadic, an analysis framework is proposed as a general guideline for implementing FWA in IT-SMEs. The **PLIC** framework comprises four phases as follows: **P** describes the **purpose** of the implementation. Before the implementation process, managers and owners need to answer why they want to use FWA in the company. **L** looks at the **limitations** of implementing FWA. **I** explains what FWA **implementing** processes for companies with different contexts look like. Finally, **C** provides detailed **consequences** of implementing FWA.

Purpose (P):

Defining a concrete purpose must be the first step of FWA/FWH implementation. As mentioned by Bolton [7], there are different variations of FWH, however, only one company in the study went beyond the first type of FWH, 'Flexibility within a day', to the second type of FWH, 'Flexibility within a week or month', by working 30 – 50 hours per week. According to Galea et al. [20], some people considered FWA as extra benefits but for others, it was a necessity. These people had special demands and responsibilities which made them improbable to work as normal employees. The special needs include employee's own sickness, child rearing, or caretaking of elderly parents. Gerdenitsch et al. [21] mentioned that there was ambiguity in the definition of FWA which was confirmed by most of the present findings. Interviewees generally did not differentiate among the terms and practices of FWH, flexplace, and compressed workweek. Many respondents used the term FWH as one of the benefits of working at home which is supposed to be flexplace. This clearly demonstrates the uncertainty of the terms in FWA. As shown in the present study, the purpose of FWA implementation can incorporated those from FWH, flexplace, staggered hours and compressed workweek together. To demonstrate why FWA cannot be evaluated separately, an example of routine travelling conditions of one employee with children was given. This employee needs FWH to pick up her children after the school-hours end. Since most primary, secondary and even high schools finish the classes around 1500 and schools are usually far away from home, parents would typically pick up their children from school back to their offices. Children would wait until the rush hours are over and go back home with their parents after the office hours are over. This is because most parents would not feel comfortable to let their kids go home with inconvenient public

transportations. Other parents would leave the office to pick up the kids from school and send them home first before going back to their office to continue their work. They inevitably need to do at least two extra commutes per day if flexplace has not been implemented alongside FWH. Commute time per trip during non-peak hours is around one hour and for peak periods could take up to three hours. The additional commute time added could be very time-consuming and tiring.

Therefore, if companies want to embrace the idea of FWH so as to support the employees with children, then they need to allow flexplace as well. The idea can similarly be applied to any other routines of personal difficulties, such as periodic medical visits for the employees themselves or their family members (e.g. parents, children, and spouses). This finding coincides with Boden's [6] conclusion that FWA can bring in a larger pool of applicable employees by answering their regimen work requirements. The present results show that flexplace can lower the cost of office usage. However, Lee and DeVoe [38] warned that if companies use FWA to reduce costs, eventually, it might result in an overall profitability loss.

Employees often feel pressured to arrive at the office on time; thus, they focus too much on working hours. FWA can make employees change their focus from working hours to working results. Hence, productivity and production of the whole company are likely to improve. Additionally, many respondents mentioned that most IT works, programming included, has to do with creativity and coming up with new ideas. Ideas might not come during fixed times, so it is better to allow them to work whenever these ideas come and let them flow as long as needed in order to maximise productivity.

Limitation (L):

There are contextual limitations that disrupt and make companies highly improper to adopt FWA. Two general factors were identified in the present study context, IT related aspects and management issues.

The first factor to look at is how companies in the IT industry generally operates. There are many types of IT companies ranging from software houses, IT customer services, and IT consulting services. The present study found that how flexible can the company be may subject to how much interaction required by its customers. For example, if the company has government bodies as its clients, the core hours of the company should be the same as the government's working hours of 0700 – 1600. If the customers are from other industries, i.e. department stores, hospitals, and banks, the company might need to work after regular working hours to avoid interruption of the client's core business. This finding is what was advised by Attia et al. [2] and Loretto and Vickerstaff [39] that owners of SMEs need to evaluate if FWA helps or hinders the nature of operations of the company.

Also, managers and owners in this research agreed that FWA was not appropriate for employees who are new hires, recent graduates, without self-autonomy, and irresponsible. Companies that use FWA would benefit greatly from employees who uses creativity to do their work rather than blue collar workers. Cultural difference in working ethics is also a concern. Most interviewees agreed that Thai employees, in general, tend to ignore the need to be fully committed to work during working hours. They use Facebook and other social media outlets during working periods so tracking working time might not be a good option for Thai people overall.

The other apparent contextual factor is the skills required by management in handling flexibility. Firstly, managerial level employees need to be capable enough to manage FWA with skills including but not limited to delegating work, tracking work, and most importantly, evaluating employees by results instead of working hours. Face-to-face working can soften the effect of low-skilled management. One extreme recommendation was not to have working hours at all. This is similar to contract work, but the difference is that they are still the company's full-time employee. Secondly, the technical side of the business must support the use of FWA. Laptops with secure virtual private networks and cloud repositories can easily enable flexplace while good communication programs will help with coordination between employees as they do not work next to each other for all working hours. Good team management and tracking systems are also needed.

Initiation (I):

Similar to the findings from Lavoie [37], De Kok et al. [14], and Kotey and Sharma [34], it is believed

that large companies have more capability in implementing FWA. Employees can cover each other's work if the company want to maintain similar performance as before. SMEs might have more flexibility due to their size and shorter hierarchy of commands. It was recommended that FWA should be implemented to low-risk-low-reward projects. Also, due to the size of a typical SME, most projects have a significant impact on the company and must not fail, unlike larger size companies that can take the time to run pilot studies to test the fitness of FWA.

The findings coincide with the literature showing that there is disagreement on how to implement the policies for FWA. Most people said that policies need to be applied to everybody in the department or company to avoid jealousy. But, even though FWA is implemented in the company, Scholarios and Marks [48] and Lambert et al. [36] warned that employees might feel insecure if their co-workers are not using it and the implementation of FWA will be just a waste. Owners should avoid any change that could harm good performing employees. One factor mentioned by many was not to implement the full flexibility because human interaction is still an important part of the social aspect of life after all.

There are many methods of FWA implementation being recommended in the literature and were confirmed by the interviewees in this study. As was suggested by Hill [29], the result concurred that the regulations on who was allowed to use FWA need to be fully explained and understood by all levels of employees. To be effective, companies should provide exposure on FWA to all employees for a short period of time first. After the employees have learnt how the FWA works, then they can be involved in the setting up of regulations and criteria for eligible employees.

Continuing discussions between the company and its employees should help to solve the problems of abuse from both sides. Firstly, Dex and Scheibl [16] agreed with most interviewees that FWA should be given on a case-by-case basis. Therefore, to obtain the rights, FWA candidates might need to do extra work to prove that they are worthy [22]. Secondly, in Thailand, 'flextime' was defined by many as 'working as many hours as you want as long as you get the job done'. Some employees commented that they had to work on average of more than 10 hours per day without any added compensation. Besides, they were occasionally asked to come work on the weekends because 'there happens to be more work'. According to James [31], if the employees refused to come, it would affect their performance reviews because they won't be considered as a team player.

Interviewees agreed that working long hours can cause fatigue, resulting in less productivity. However, it may be possible for people's bodies to adjust to working longer hours over time.

Consequences (C):

If a company wishes to implement FWA, then it needs to accept and explain the consequences to employees throughout the implementation period. To improve the productivity of software engineers, Perlow [47] recommended the use of 'quiet time', which is the time that people could work without any interruption. Most FWAs, when implemented, will incorporate this 'quiet time' scheme as it is a typical brainchild of FWA. The 'quiet time' implementation does come with consequences, such as the cost of decreased communications and increase interaction time between employees.

To mitigate these effects, employees of all levels need to understand the concept of 'asynchronous communications'. Since not all questions need immediate answers, allowing more 'quiet time' should make people work in a more maturing manner. However, this type of working environment might cause the company to be fragmented and less unified.

To conclude, IT companies by nature needs to keep up with rapid changing environment within its industry. Consequently, changing the nature of their operations in order to keep up with the pace of technology and inevitably force the FWA to revise and readjust all the time. In the end, after careful and thorough evaluation, many interviewees decided that it might be wise not to implement FWA in their companies at all.

Conclusion

The main purpose of this research is to find a good strategy to implement FWH for IT-SMEs. Since there is no study, to the best of the researcher's knowledge, that examine the implementation strategy of FWH in IT-SMEs from an emerging country; this research can provide insights to the field.

From the literature review, research on FWH/FWA was based in the production companies of western world setting. Most research seeks to identify the type of possible benefits received from implementing various configurations of FWH/FWA. The two systems have separate definitions. However, based on the interview results, the conclusion from this research is different because the findings show that in practice the respondents were unable to separate FWH from FWA.

While some researchers suggested the use of FWH/FWA to maintain the WLB of employees across all company settings, the present study has a different conclusion. Nevertheless, the findings concur with Lavoie's [37] suggestion that there is no one-size-fits-all for implementing WLB policies in SMEs. Even with similar organisational contexts such as software houses, companies differ greatly. In addition, several of them do not allow any type of FWA to be implemented at all. Thus, it is necessary for each company to take a more holistic approach in figuring out which particular FWA practice can or cannot be used to suit the company culture.

Many factors are reported in the literature to have a positive effect on the implementation of FWA. These factors are seen as benefits to the organisation and are the reasons why companies in the western world use various forms of FWH/FWA. The present result from IT-SMEs data has concluded the following similar positive factors:

- The operation nature of the company [12], for instance, customers that require implementing systems at non-regular hours, coordinating work with people from different time zones, IT work that is time sensitive such as server monitoring.
- Traffic congestion of the routine travelling routes of employees. This factor is particularly important for employees with children in schooling ages.
- IT and creative personnel stereotypes of being insensitive to time or prefer to work late at night.

Although there are factors that positively influence the need to implement FWH/FWA, a large number of the study samples indicate their implementation concerns. Based on the findings, there are specific impediment factors that can be concluded:

- Inadequate management skills necessary, such as project work coordination, work progress tracking systems, and performance appraisal.
- Thai unique conflict resolution culture, 'Grengjai'.
- Needs for co-worker's communications in term of 'quiet time' versus 'interaction time'.
- Unclear or questionable policy in applying the FWA system to everyone equally in the organisation.
- Insufficient technology infrastructure of the company to facilitate work processes.
- Inappropriate types of employees (e.g., new hires, recent graduates, employees without self-autonomy, and irresponsible employees.

Taking into consideration the foregoing positive and negative factors, the researcher developed a recommendation using a four-phase cyclical framework PLIC that managers should go through when implementing any FWA for the company. Thus, the following conclusion can be made regarding key learning points throughout the processes:

- Understand the concepts how 'quiet time' and 'interaction time' could improve productivity by being 'in the zone'.
- Learn how to use 'asynchronous communication' effectively and recognising that not all questions need immediate answers.
- Understand employee needs and what management can do to accommodate them.
- Determine how management can use 'peer pressure' from co-workers to avoid conflict with management.
- Understand why evaluating working results instead of time is beneficial for the company in the long run.
- Learn how different variations of FWH and FWA relate to one another.

Recommendations for future research

The present research project found some interesting results that warrant future research. Four issues stand out as follows:

- Culture effect. Most researches in FWA and WLB was done in the western world, more precisely, in the UK, U.S., Europe, Canada, and Australia. People and companies operating in developing countries perceive things much differently, therefore, studies on FWA can be enriched with evidence from other countries.
- Data collection method. Papers on FWA and WLB were frequently done by using interviews or questionnaires which might not get to the root of the problem. Data collection by observation techniques could bring new ideas to the field.
- Research methodology. Since FWA implementation is quite complex, a longitudinal study can provide a better understanding of how different stakeholders perceive the changing of policies from the evolution of FWA in an organisation.
- Uniqueness of IT companies as research samples. For example, how the Scrum framework and IT employees as permanent contractors can revolutionise the landscape of FWA system.

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Appendix - List of Abbreviations

FWA	Flexible Work Arrangements
FWH	Flexible Working Hours
IT	Information Technology
SME	Small and Medium-sized Enterprise
WLB	Work-Life Balance
Flexplace	Flexible Working Place
MBB	Messerschmitt-Bölkow-Blohm
VOIP	Voice-Over-Internet-Protocol
PLIC	Purpose-Limitation-Implementation-Consequences

The Effectiveness of Applying Augmented Reality Visualization in Teaching Audit Risk Model Concept

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Abstract

This study investigate whether lecturing audit risk model with the use of augmented reality is more effective than that without the use of augmented reality. To measure the effectiveness of using augmented reality for students' understanding, we designed to use within subject test by comparing pre and post scores for 12 items audit risk concept test. We find that the scores of audit risk model test after using augmented reality significantly increase from those before using augmented reality. The study has implication for improving students' understanding of audit risk concept and enhance their applying knowledge to more complex situation.

Keywords:

Audit Risk Model, Augmented Reality, Cognitive Learning

Introduction

Audit risk is one of the major key concept in auditing that Bachelor students learn from auditing class. Audit textbooks and auditing teachers usually start with the definition of audit risk as the risk of auditors for express his/her inappropriate opinion on the financial statements. The audit risk comprises of three components; inherent risk, control risk, and detection risk. The definition and some examples of these three components are given to the class. To apply this audit risk concept for students, teachers always show the audit risk model as the mathematic function as audit risk equal to inherent risk x control risk x detection risk.

Audit risk model

The risk of auditor or audit risk is the probability that an auditor expresses an inappropriate opinion. To manage this audit risk, the Thai Standard on Auditing no.315, complying with International Standard on Auditing no.315, states that auditors should understand and assess client's business risk and client's control risk. These two risks called Risk of Materiality Misstatement (RMM), which is the risk that a material misstatement exists in the unaudited financial statements. Hence, auditors should plan and execute audit procedures to detect and correct this material misstatement

The Statement on Auditing Standards (SAS) No.107 states that audit risk is a function of the risk that the financial statements are materially misstated (RMM) and the risk that auditor will not detect such material misstatement (called detection risk). The auditing standards determine that auditors should seek and use various approaches to finally express their opinion on the financial statements at an appropriately low level of audit risk. This statement means that auditors initially determine their suitably low level of audit risk, then assess risk of materiality misstatement (RMM). Based on the predetermined acceptable audit risk and the assessed RMM, auditors would get the level of detection risk, which lead to their audit procedures or audit methodology. For example, when auditors encounter high RMM, they must lower detection risk to maintain their acceptable audit risk. In theory, detection risk is decreased by putting more effort, increasing substantive testing, and getting more evidence.

Extant auditing researches mainly focus on the auditor's process related to audit risk model. For instance, Bedard 1989, Mock and Wright 1993 and Mock and Wright 1999 examine the association between assessed client risks and auditors' planning decision. Some researchers investigate each element of audit risk model such as control risk with audit fee or earnings quality (Doyle, Ge and McVay 2007, Hogan and Wilkins 2008) or study auditor's perception of business risk and audit fee (Bell, Landsman and Shackelford 2001).

Regarding to the auditing standard, the higher RMM (inherent risk and control) the auditor faces, the more audit effort would be. However, there are non-compliance results with respect to audit risk model. Audit effort (audit hours and audit team compartment) are sensitive to inherent risk but unrelated to control risk (O'Keefe et al, 1994). Felix et al. 2001 also found that control reliance is not associated with audit effort.

Classroom learning

Learning styles have been studied for long time. Cassidy 2004 provided an overview of theories, models and measures for learning styles. Many researchers develop learning style model to assess learning style preference in order to figure out how to improve learning outcome. The Learning style model of Kolb, 1985 states that individual learning style is based on two dimensions, perception or prehension dimension and processing dimension.

The perception or prehension refers to the grasping of information from experience. This can be divided into two groups. One is concrete experience (CE) which prefer experiential learning. People in this group wants to look things as it is and do not like to think about things. The other is abstract conceptualization (AC). People in this group have a preference for conceptual and analytical thinking. After they see something, they would like to internally process in their brain to get more understanding in big picture as conceptual framework. Thus, their grasping information from their thinking.

The other dimension of Kolb 1985 is the processing dimension which refer to individual process style. The first process style is active experimentation (AE). People in this group would like to try no matter it is right or wrong (trial and error learning). The other group is reflective observation (RO). They do not want to try by themselves but consider the task and see the solution whether it works.

Based on these two continuum, Kolb 1985 classifies learner into four groups:

1. Accomodator (CE-AE): The accommodator uses active experimentation and his concrete experience. He tends to action promptly and adapt to diverse situation. He prefer hands-on learning or practical learning.

2. Diverger (CE-RO): The diverger uses his concrete experience and think deeply from one experience to various possibilities. He loves logical instruction.

3. Converger (AC-AE): The converger uses abstract conceptual to drive experiment. He starts by understand the tasks in big picture (abstract understanding) and think carefully about tentative strategies and act on their thinking. He prefer interactive learning.

4. Assimilator (AC-RO): The assimilator prefer to think than to act. He loves to learn on lecture base (listen and thinking, but no action).

Students in different undergraduate majors have different learning styles (Kolb, 1985). In addition to educational branch, culture could impact learning styles (Sauceda-Castillo, M. J., 2001, Evan and Waring, 2011, McKee et al 1992). McKee et al 1992 indicates that Norwegian students mainly are assimilator while US students are converger. Sauceda-Castillo investigates learning styles among different ethnic group and found that Asian students are likely to be assimilator who love lecture-based learning, especially when they study introductory course.

Academic literatures on education emphasize that teaching methodology that match with preferred learning style of student would effectively improve understanding of learner (O'Leary and Stewart, 2013). Profession has long called for changing teaching format in accounting classrooms. Previous evidences present that in-class simulation exercise or team learning are more effective than traditional lecture (Phillip, M.E. and Graeff, 2014, Opdecam, E., Everaert, P., Keer, H.V. and Buysschaert, F., 2014). Lecture-based teaching has been used for teaching accounting subjects for long time, especially in Thailand. Delivering the exercises, cases and problems in the accounting class encourage more active learnings. However, this method depends on students' knowledge and understanding of the core principles of accounting. Auditing is normally taught for third- or forth year undergraduate students as this subject integrates basic accounting knowledge together with information system taxes, and corporate strategy. Whilst extant research found that students in high level course prefer convergent learning style (Baker et al 1986; Brown and Burke, 1987) with which match interactive learning, students prefer to be instructed, given the solution (or lecture) when they learn new subject such as ethic in auditing class, no matter they are in final year of accounting studies (O'Leary and Stewart, 2013). Thus, lecturers normally use traditional lecture base for teaching auditing as there are various fundamental auditing concepts that should be explained in details such as professional qualification, management's financial statements assertion, audit risk model, etc.

Since the audit risk model is one of the most important concept for auditing and very new topic for students, teachers gradually instruct in each audit lecture classroom. The instruction normally starts with the definition of audit risk as the risk of auditors for express his/her inappropriate opinion on the financial statements. The elements of audit risk are subsequently explained, by using the mathematic function as audit risk equal to inherent risk x control risk x detection risk stated as follow:

Audit Risk = Inherent Risk x Control Risk x Detection Risk

or

Audit Risk = Risk of Material Misstatement x Detection Risk

Based on processing information theory, presenting the above mathematic equation would make new information more meaningful to students. Instructors prefer quantitative to qualitative illustration whilst the auditing standards (SAS No.107) allows auditors to evaluate the components of audit risks either in quantitative terms such as percentage, or in nonquantitative terms such as high, medium, or low.

Students, although easier understand audit risk model by using percentage, still need to deeply understand this concept. If students could link this abstract concept to picture they have seen, they would have recall their prior understanding of audit risk model, based on Dual-Coding Theory (Chen, 2004).

Human has limited working memory capacity. When people learn multimedia, they process information through both verbal and visual. Traditional lecture provide both verbal and text visual. Even though combination of text and picture could improve learning outcomes than text alone, the effectiveness of mixture depend on learning task, individual characteristics, etc. However, picture or animation could raise attention to the audience, leading to information process in mental. Therefore, this paper

study whether adding animation to traditional lecture would benefit to learner and raise learning outcome on audit risk model, regardless cognitive styles of learners.

Augmented reality

Augmented reality is utilized as the visualizing technology and is designed to represent audit risk model. The white raining doll represents auditor. Rainfall represent risk. The more rainfall, the more risk auditor face. The cloud and the roof represent inherent risk and control risk, respectively. In order to link the meaning of inherent risk as risk that has already existed regardless of internal control, cloud is chosen to be a picture representative. Dark cloud means high inherent risks as it contains more rainfall whereas white cloud means low inherent risk. The roof is chosen to represent the internal control of client. If the roof has big hole, client's internal control has large loophole which make high opportunity of errors fall into the financial statements. The leaf hold by a white doll mean audit procedures that auditor make decision to do to protect himself (see Figure 1).

By using this simulated object which links picture to audit risk concept, learner would be interested in this abstract topic and might be able to develop better cognition, perception, and reasoning.

Research methods

Data collection This study involves the third-year students from the Bachelor of Accountancy program in a large public university because they took auditing course from four lecturers. All lecturers use traditional-based lecture with the same materials and textbook. To compare learning outcome of using traditional-based lecture versus adding augmented reality visualization to lecture, we conduct a within-subject experiment study. Thirty eight students from four lecturer class voluntarily and willingly participated in Augmented reality class by one lecturer as we did not give any credit or extra-scores for them. Two of participants did not answer all questions. Thus, the usable samples consist of thirty-six respondents.

Procedure After participants learn from four teacher by traditional-based lecture, they filled-in a consent letter and a set of questionnaire including demographic questions and twelve-item knowledge test of audit risk model (so called "pretest"). In order to reduce the recency effect of the traditional-based lecture, voluntarily participants are joined the augmented reality lecture after traditional-based lecture pass three weeks. After participants learn from one teacher using augmented reality, they are asked to self-assess their understanding audit risk model. In addition, they evaluate their perceived ease of use, perceived usefulness, their intention to use in class. Finally, participants perform twelve-item knowledge test of audit risk model (so called "posttest"). The posttest questions are the same as the pretest questions, but the questions and the answer are reordered. This knowledge test is validated by the other two professors who teach auditing class.

Tables 1: Lecture Treatment-Within subject test

	Traditional-based lecture	Augmented Reality-based lecture
Students	Pre-Test	Post-Test

Model specification The experiment uses 2 x 1 within-subject design (traditional-based versus augmented reality-based). The research model is as follow

$$Y_{ij} = \mu + \tau_i + \varepsilon_{ij}$$

where Y_{ij} is Audit risk test score

τ_i is Lecture level and i = 1 if traditional-based

i = 0 if augmented-reality

Research instrument Audit Risk Model is used to construct augmented reality visual (Figure 1).

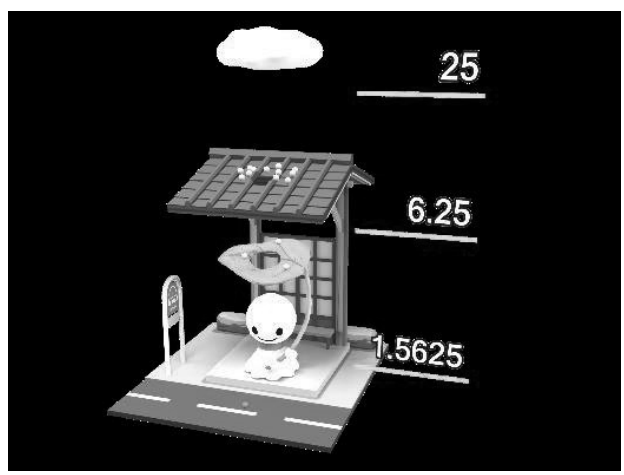

Figure 1: Audit Risk Model Visual

Results

Descriptive statistics of thirty-six participants are presented in table 2. The average score (SD) in the traditional-based lecture (or the pre-test) is 9.42 (1.65), ranging from 8.14 (1.40) to 10.50 (2.12). The mean score (SD) in the augmented reality-based lecture (or the post-test) is 11.44 (0.73), ranging from 11.14 (0.38) to 11.86 (0.82). Students from each section have higher post-test score than pre-test score, indicating that they seem to be more understanding the audit risk model when using augmented reality. We cannot compare the significance level of improvement for each section due to limitation of small sample size in each section. For example, there are only two students in section 1. Therefore, the within-group assessment is performed in table 3 and the results indicate that the score after using augmented reality (post-test) is significantly increase from that before using augmented reality (or pre-test or traditional-based) with p value = 0.00 and F-test = 60.97 in table 3.

Tables 2: Descriptive Statistics-Within group

Score	Section	N	Mean	SD
Traditional-based (Pre-test)	1	2	10.50	2.12
	2	20	9.65	1.60
	3	7	9.71	1.50
	4	7	8.14	1.46
Total		36	9.42	1.65
Augmented reality-based (Post-test)	1	2	11.50	0.71
	2	20	11.40	0.82
	3	7	11.86	0.38
	4	7	11.14	0.69
Total		36	11.44	0.73

Tables 3**:** Within groups assessment of effectiveness of

audit risk model visuals

Source	N	Mean squares	*F-Statistics*	Significance**
Score	36	74.01	60.97	0.00
Error		1.21		

**Two-tailed equivalent given directional prediction.

Tables 4: Between groups assessment of pre-test score

Source	N	Mean squares	*F-statistics*	Significance**
Group	36	5.14	2.07	0.12

**Two-tailed equivalent given directional prediction

Tables 5: Between groups assessment of effectiveness of

audit risk model visuals

Source	N	Mean squares	*F-statistics*	Significance**
Group	36	4.04	2.19	0.11
Error		1.845		

**Two-tailed equivalent given directional prediction.

Due to the traditional-based lecture is done by four lecturers in four section, we ensure that the knowledge from four lecturers are not different by testing between groups of pre-test score. Table 4 shows that the pre-test scores among four section are insignificantly different (p = 0.12, F statistics = 2.07). Students lectured by different traditional-based lecture teachers perform indifferently. In addition, these students show significantly improve in their post-test score. This improvement among students from four section is insignificantly different (p value = 0.11, F statistics = 2.19, table 5). The planned comparison between group assessments in table 6 also confirm the indifferent performance of groups.

Tables 6**:** Planed comparison between groups assessment of effectiveness of audit risk model visuals

Group	Mean Difference	*t-statistics*	Significance*
1 vs. 2	-0.75	-0.66	0.26
1 vs. 3	-1.14	-0.93	0.18
1 vs. 4	-2.00	-1.63	0.06
2 vs 1	0.75	0.66	0.26
2 vs 3	-0.39	-0.59	0.28
2 vs 4	-1.25	-1.86	0.04
3 vs 1	1.14	0.93	0.18
3 vs 2	0.39	0.59	0.28
3 vs 4	-0.86	-1.05	0.15
4 vs. 1	2.00	1.63	0.06
4 vs. 2	1.25	1.86	0.04
4 vs.3	0.86	1.05	0.15

*One-tailed equivalent given directional prediction.

Regarding to participants' learning experience with this augmented reality (table 7), they respond that they could better understand audit risk model. Their mean (SD) perception is 4.81 (0.40) which is significantly higher than the middle likert scale of 3. In term of the perception toward Audit Risk Model Visualization, participants perceived Augmented reality-Audit risk model provide clear structure of audit risk (C1 Mean (SD) = 4.69 (0.47)), allowing them to better understand the meaning of each compartments of audit risk model (C2 Mean (SD) = 4.44 (0.56), and they could better make decision on how to reduce audit risk based on this structure (C3 Mean (SD) = 4.44 (0.56)).

In view point of system, respondents viewed that the system is not difficult to use (S2 Mean (SD) = 4.36 (0.68), not complex (S1 Mean (SD) = 4.44 (0.65), has well integrated functions (S4 Mean (SD) = 4.47 (0.56), could learn to use in short period (S7 Mean (SD) = 4.58 (0.60), and be confident to use (S8 Mean (SD) = 0.85). Since the augmented reality of audit risk model does not have soundtrack of explanation, students feel a little difficult to learn by themselves (S9 Mean (SD) = 3.47 (0.94)).

In respect of usefulness of augmented reality, students rated that the visualization of audit risk model is useful (U2 Mean (SD) = 4.06 (0.79) and can utilize in audit planning to reduce audit risk (U1 Mean (SD) = 4.56 (0.61). They positively recognized the augmented reality of audit risk model as they stated that they intend and encourage to use this visualization in auditing class in the future.

ables 7: Analysis of learning experiences on audit risk model visuals

Questions (N = 36)	Means	SD	t-statistics	Significance*
Understanding	4.81	0.40	26.99	0.00
Cognition/Perception toward Audit Risk Model Visualization	4.69	0.47	21.76	0.00
C1. Clear structure of audit risk	4.44	0.56	15.54	0.00
C2. Understand Meaning	4.44	0.56	15.54	0.00
C3. Apply structure to make decision on reducing audit risk				
System				
S1. Unnecessarily complex	4.44	0.65	13.29	0.00
S2. Easy to use	4.36	0.68	11.97	0.00
S3. Need technical experts	3.81	1.24	3.90	0.00
S4. Well integrated functions	4.47	0.56	15.78	0.00
S5. Inconsistency	4.22	0.80	9.20	0.00
S6. Cumbersome to use	4.36	0.68	11.97	0.00
S7. Learn to use quickly	4.58	0.60	15.74	0.00
S8. Confident to use	4.28	0.85	9.03	0.00
S9. Difficult to learn	3.47	0.94	3.01	0.00
Usefulness				
U1. Indicate audit planning to reduce audit risk	4.56	0.61	15.38	0.00
U2. Usefulness audit risk model visuals	4.06	0.79	8.01	0.00
Intention to use				
I1. Should be used in the future	4.42	0.55	15.34	0.00
I2. Intent to use (if any)	4.75	0.44	23.91	0.00

The means score of S1, S3, S5, S6 and S9 was calculated after reversal of negative measures into scale rating from 0 (Disagreed) to 5 (Extremely agreed). *One-tailed equivalent given directional prediction.

Discussion and conclusion

The purpose of this study is to examine the effectiveness of using augmented reality in teaching abstract concept of audit risk model. Augmented reality is chosen as the visualizing technology and is designed to represent audit risk model. The study uses within subject test by comparing scores from traditional-based lecture to scores from augmented reality-based lecture. Both the knowledge test and participants' perception survey indicated that students could better understanding audit risk model with the augmented reality, in spite of difficulty to use by themselves. Participants recognized the usefulness and not complicated system. They encourage instructor to use this augmented reality in the auditing class in future. It would be more useful if the augmented reality tool has an explanation audio or soundtrack, so that they can learn by themselves and more interact with this tool.

As O'Leary and Stewart, 2013 emphasize that importance of matching between individual learning styles with teaching methodology, this study did not measure students' learning preference. Future research could explore whether the effectiveness of this augment reality depend on learning style of students. In addition, developing augmented reality with audio explanation of audit risk model would be more interesting to do as it would increase interaction opportunity for students, leading to more interesting and higher learning outcomes.

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A Management System for Information Systems Operational Performance

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Abstract

As the importance of and the dependency of business on the information systems (IS) increases, IS operations become an important activity in the business. In order to reduce the IS operational costs and to to utilize IS effectively in the business, the performance of IS operations should be assessed and managed. This important management of IS operations is frequently neglected both in practice and in research.

This study, based on an action research approach, examines a case company that successfully develops and implements a system managing the IS operational performance. It suggests the procedure, technique and deliverables needed to develop an IS operational performance management system, and summarize the evaluation results after implementing the system.

From the practical perspective, the results of the study will provide useful information to the organizations attempting to develop an IS operational performance management system. In addition, academically, the study is expected to contribute to the advance of the IS operational performance area in which research is relatively scarce.

Keywords

Information System Operations, Performance Management, Management System, IS Operations Management

Introduction

Recently, as the dependency of business on the information systems (IS) increases, problems occurring in IS affect the business severely. Thus, IS operations, which are regarded as simple and low value-added activity in the past, are now recognized as a very important activity in the business [17]. Assessing and managing the performance of IS operations is a must to reduce the increasing costs of IS operations and to utilize the IS effectively in the business [15].

In practice, this important management of IS operations is frequently neglected [13], [15], [20]. That is, while most of the business manages the investment on IS thoroughly when they develop IS, they tend to neglect the management of IS operations even though the cost of which occupies major portions of the total IS costs.

Academic endeavors show similar pattern with that of the practice; while the performance of IS development has been studied relatively well [2], [3], [4], [16], research on the performance of IS operations is relatively scarce [12]. Therefore, studies on the simple and objective management of IS operational performance which both IS department and business users/managers can agree are needed.

This study, based on an action research approach [1], [6], [7], summarizes a case in which a management

system for IS operational performance is successfully implemented and applied. The aims of the study is to provide a practical solution which can be referenced by the organizations trying to develop an effective management system for IS operational performance, and research results that can be used as foundation for further research in the area.

Case Company

The case company is a large B2B firm which manufactures the display units. The company is composed of 3 manufacturing centers, 5 divisions and 7 overseas offices and emphasizes the technology development.

Since the company is competing with the global companies, there is a continuous pressure for speedy rollout of the new products and price reduction. To cope with the problems, the company is operating a global supply chain management system to efficiently manage the entire process of developing and manufacturing of products, quality assurance, acquisition, and logistics. In addition, all business operations are closely aligned with IS.

The company has recently experienced mergers twice and there was a need for stabilizing the IS as early as possible. Thus, the company has established a strategy to develop user-oriented management system for IS operational performance.

Analysis Results

The current status of IS operations in the company is evaluated through VOB (Voice of Business) and VOC (Voice of Customer) with users and management. The results demonstrate a need for the establishment of a system to monitor the use of IS regularly. Therefore, a project plan is developed (<Table 1>) and a 6-month project is carried out based on the plan.

Table 1. Project Schedule

activities	1M	2M	3M	4M	5M	6M
Define the goals of IS operations						
Select the performance indicators of IS operations						
Define the calculation formula and description of indicators						
Review and confirm the indicators						
Establish a monitoring scheme for IS operational performances						
Implement an information system for IS operational performance management						

Details of the activities performed in the projects are summarized (the final activity, implementing IS for operational performance management, is not within the scope of this paper and is not explained).

1. Define the goals of IS operations

In this stage, (1) visions and goals of IS operation are defined using IT balanced scorecard (BSC) perspectives: business contribution, user orientation, efficiency of operations, and future orientation [10]; (2) Performance Driver Tree (PDT) that represents causal relationships among the factors affecting the performance goals is developed; (3) 20 Critical Success Factors (CSFs) are derived based on the PDT; and (4) causal relationships among 20 CSFs are identified, and the CSFs are grouped into 4 perspectives of IT BSC. The results are depicted in <Figure 1>).

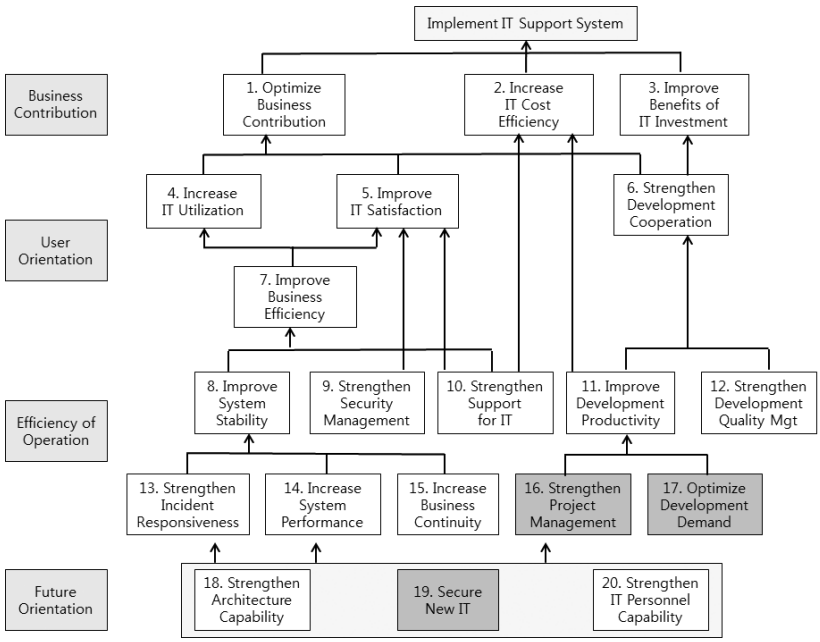

Figure 1. Goals and CSFs of IS Operations

2. Select the performance indicators of IS operations

During the stage, (1) about 70 candidate indicators to measure operational performance are identified using the existing indicators and benchmarking; (2) the candidate indicators are analyzed to exclude the indicators related to IS development and to combine similar indicators, resulting in 44 indicators. Then, the indicators are grouped by 17 CSFs identified in the previous stage; and (3) of the 44 indicators, 18 indicators are finally selected after the evaluation. The evaluation of the indicators are performed by 7 project members using 7 criteria of the e-BSCMAD model [4]. Of the 18 indicators, 12 indicators that can be managed by the IS department itself are excluded. The remaining 6 indicators that should be shared with users are finally selected as the performance indicators of IS operations. To improve the efficiency of the indicator management, the 6 indicators are grouped into 4 categories Table 2.

Table 2: Final Performance Indicators of IS Operations

Dimension	Indicator	Description
Implementation	extent of implementation	ratio of implemented system functions over total business process
	extent of system changes	number of change requested within 3 months after go-live of the system
Utilization	Screen utilization rate	ratio of screens used over the total screens
	User utilization rate	ratio of users using the system over the total authorized users
Satisfaction	User Satisfaction	user satisfaction survey results (bi-annually)
IT Cost	Operational Cost	Cost for IS maintenance

3. Define the calculation formula and description of indicators

(1) Calculation formula for the selected indicators are defined (<Table 3>); and (2) description of the indicators is prepared in the following fashion (<Table 4>).

Table 3. Calculation Formula of Indicators

Dimension	Indicator	Initial Formula	Revised Formula
Implementation	extent of implementation	(# of implemented functions / # of total target functions × 100 - extent of system changes	
	extent of system changes	# of change requested within 3 months after go-live of the system	
Utilization	Screen utilization rate	(# of utilized screens / # of total screens) × 100	(# of utilized screens / # of total screens) × 100 - penalty * penalty: ratios of the screen not used 6-month after system implementation (6~10%: -1, ~15%: -2, ~20%: -3, above 20%: -5)
	User utilization rate	(# of users accessing the system / # of total users) × 100	(# of primary users accessing the system / # of total primary users) × 100 × 0.8 + (# of secondary users accessing the system / # of total secondary users) × 100 × 0.2
Satisfaction	User Satisfaction	things to be improved(2). change of business(4), change of info.(3), quality(2), training(2), system integration(2), system support(4)	overall(3), system quality(2), info. quality(2), service quality(4)
IT Cost	Operational Cost	method of cost allocation • common application(e.g., groupware, personnel system) - allocate by the # of personnel • specific application(e.g., marketing, purchasing system) - allocate by the # of actual use of the system	

* calculation formula for screen utilization rate, user utilization rate, and user satisfaction are changed and improved based on the results of the evaluation performed quarterly from March of 2012,

Table 4: Description of Indicator (screen utilization rate)

Name		screen utilization rate			
Description		utilization rate of each screen			
Purpose		identify reasons for not using the screen, implement improvement activities			
Formula		(A / B) × 100			
Unit		%			
A	Definition	# of screens used more than 3 times	B	Definition	total # of screens
	Unit	# of modules		Unit	# of modules
	Collection Method	system generated		Collection Method	system generated
	Data Source	IT portal		Data Source	IT portal
Measuring Interval		Quarterly			
Remark					
Contact		John Smith			

4. Review and confirm the indicators

In this stage, (1) the selected indicators are reviewed to determine whether continued maintenance of them is needed. The results of the review confirm that continuous improvement and management of the indicators since the values of the indicators are low; (2) efforts are exerted to obtain users' agreement with the selected indicators including workshops and performance committee meeting; and (3) purpose, scope of application, operational procedures and criteria (including R&R), related rules, and revision history of the description of indicators are verified and finally confirmed.

5. Establish a monitoring scheme for IS operational performance

A system that monitors the performance of IS operations continuously and systematically is established (<Figure 2>).

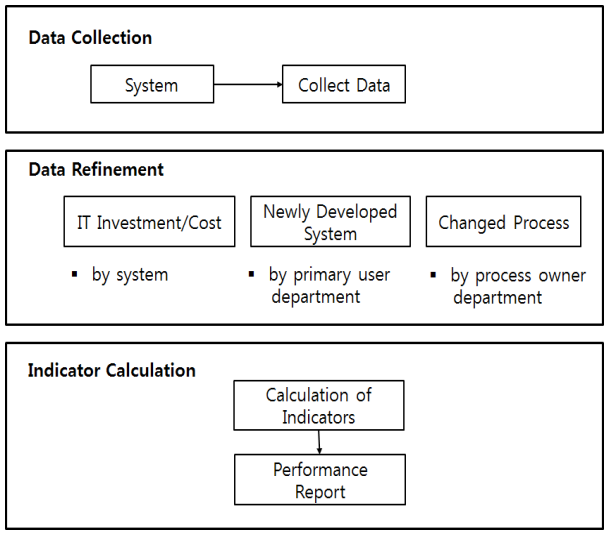

Figure 2: Monitoring Scheme for IS Operational Performance

(1) During the data collection stage, data are collected directly from each system to ensure accuracy, reliability and objectivity of the indicators; (2) in the data refinement stage, IT investment/cost data are calculated by totalling both direct and indirect costs for each system. For the newly developed systems, a primary user department is selected to refine the data. In case that a business process is changed, the process owner department refines the data about the process; and (3) in the indicator calculation stage, value of the indicators is calculated based on the calculation formula. In case that value of the indicators deviates from the established criteria, the responsible staff analyze the cause of the problem and develops measures to resolve the problem. Finally, a report on the performance of IS operations is prepared.

Conclusions

After implementing the systems, the performance of IS operations has been evaluated bi-annually. The results of the evaluations are summarized in <Table 5>

Table 5: Evaluation Results

	1st (2012 2nd half)	2nd (2013 1st half)	3rd (2013 2nd half)	4th (2014 1st half)
extent of implementation (%)	88.0	85.9	86.5	90.0
Screen utilization rate (%)	42.6	75.3	76.4	90.1
User utilization rate (%)	34.5	74.1	78.4	85.6
User Satisfac-tion(point)	63.4	73.4	73.5	76.0
IT Operational Cost (%)*	3.8↑	12↓	0.2↓	2.5↓
improvement initiatives(#)	107	119	111	135

* denotes the rate of increase/decrease against the last period

During the periods, the performance of IT operations is measured and more than 100 improvement initiatives are performed in each period. Thanks to these efforts, all indicators are improved; 4th evaluation results compared to 1st results show 2%p improvement in the extent of implementation, 47.5%p in the screen utilization rate, 51.1%p in the user utilization rate, 12.6 points in the user satisfaction. Operational costs show downwards trends. In sum, there are sufficient evidence to conclude that IS operations of the company have been improved. This confirms the previous research results [15] [16] [19], in that the cost of IT operations increases dramatically, as the system gets old. However, if the IS operations are well managed, the cost can be reduced and the life of system can be extended.

This study examines the case of a company that successfully develops and implements a system managing the IS operational performance based on the action research approach. The analysis results suggest the procedure, technique and deliverables needed to develop an IS operational performance management system, and summarize the evaluation results after implementing the system.

From the practical perspective, the results of the study will provide useful information to the organizations attempting to develop an IS operational performance management system. In addition, academically, the study is expected to contribute to the advance of the IS operational performance area in which research is relatively scarce.

However, the study has a few limitation, and future research is needed taking the limitations into consideration. This study analyzes how much the indicators have improved, and demonstrates that the cost of IS operations has decreased resulting from the improvement. However, this study does not analyze the relationships among indicators and which indicator has contributed to the cost reduction how much. Future research is needed in this respect. In addition, this study excludes the indicator for which IS department is responsible from the analyses on the ground that the case company has an ability to manage them by itself. However, a study is needed to consider a more comprehensive management system that includes the above indicators for the organizations that do not have ability to manage the indicators properly.

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Data Security and Privacy Issues in Cloud Computing

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Abstract

Cloud computing is the long dreamed vision of computing as a utility, where users can remotely store their data into the cloud so as to enjoy the on-demand high quality applications and services from a shared pool of configurable computing resources. Many enterprise applications and data are migrating to public or hybrid cloud, but regarding some business-critical applications, the organizations, especially large enterprises, still wouldn't move them to cloud. Cloud technologies and models have not yet reached their full potential and many of the capabilities associated with clouds are not yet developed and researched to a degree that allows their exploitation to the full degree, respectively meeting all requirements under all potential circumstances of usage. There are lots of challenges that still need to be addressed in this domain. So, in this paper a description of various services and deployment models of cloud computing is presented. Also, data security and privacy issues in cloud computing specially in different deployment models are discussed.

Keywords:

Cloud computing; data security; cloud deployment types.

Introduction

From initial concept of building to current actual deployment, cloud computing is growing more and more mature. Nowadays many organizations, especially Small and Medium Business (SMB) enterprises, are increasingly realizing the benefits by putting their applications and data into the cloud. The adoption of cloud computing may lead to gains in efficiency and effectiveness in developing and deployment and save the cost in purchasing and maintaining the infrastructure. Regarding definition of cloud computing model, the most widely used one is made by NIST as "*Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model promotes availability and is composed of five essential characteristics, three service models, and four deployment models.*" [1]. The cloud computing model wich NIST defined has three service models and four deployment models. The three service models, also called SPI model, are: Cloud Software as Service (SaaS), Cloud Platform as a Service (PaaS) and Cloud Infrastructure as a Service (IaaS). The four deployment models are: Private cloud, Community cloud, Public cloud and Hybrid cloud.

Clouds suffer from major security concerns, for example: physical resources shared by many (possibly competing) customers – what is known as the *multi-tenant architecture*; vulnerability to the insiders threat of traditional enterprises; complex and heterogeneous architecture increasing security vulnerabilities. In addition, the Cloud elasticity results in security vulnerabilities when replicating, distributing, and shrinking data. This process must validate the non-existence of security holes in remote servers. Equally importantly, in current Cloud users do not have control over their resources, for example users cannot be assured about the way Cloud manages resources, about the integrity of their bills, and about Cloud's compliance with the greed SLA [1].

Compared with the traditional IT model, cloud computing has many potential advantages. But from the consumers' perspective, cloud computing security concerns remain a major barrier for the adoption of cloud computing. According to a survey from IDCI in 2009, 74% IT managers and CIOs believed that the primary challenge that hinders them from using cloud computing services is definitely cloud computing security issues (BNA, 2009)[6]. Another survey carried out by Garter in 2009, showed that more than 70% CTOs believed that the primary reason not to use cloud computing services is that there are data security and privacy concerns.

Analysts' estimate that within the next five years, the global market for cloud computing will grow to $95 billion and that 12% of the worldwide software market will move to the cloud in that period. To realize this tremendous potential, business must address the privacy questions raised by this new computing model [6]. Cloud computing moves the application software and databases to the large data centers, where the management of the data and services are not trustworthy. This unique attribute, however, poses many new security challenges. These challenges include but not limited to accessibility vulnerabilities,virtualization vulnerabilities, web application vulnerabilities such as SQL (Structured Query Language) injection and cross-site scripting, physical access issues, privacy and control issues arising from third parties having physical control of data, issues related to identity and credential management, issues related to data verification, tampering, integrity, confidentiality, data loss and theft, issues related to authentication of the respondent device or devices and IP spoofing. Though cloud computing is targeted to provide better utilization of resources using virtualization techniques and to take up much of the work load from the client, it is fraught with security risks [20].

So in This paper in section 2 different security and privacy issues in three service models are discussed and in section 3 some security solutions are proposed.

Security Issues in Service Models

A recent survey by Cloud Security Alliance (CSA) & IEEE indicates that enterprises across sectors are eager to adopt cloud computing but that security are needed both to accelerate cloud adoption on a wide scale and to respond to regulatory drivers[8]. It also details that cloud computing is shaping the future of IT but the absence of a compliance environment is having dramatic impact on cloud computing's growth. Organizations using cloud computing as a service infrastructure, critically like to examine the security and confidentiality issues for their business critical insensitive applications. Yet, guaranteeing the security of corporate data in the ''cloud'' is difficult, if not impossible, as they provide different services like SaaS, PaaS, and IaaS. Each service has its own security issues [12].

A. Security Issues in SaaS

SaaS (Software as a service) is a software deployment model where applications are remotely hosted by the application or service provider and made available to customers on demand, over the Internet. The SaaS model offers the customers with significant benefits, such as improved operational efficiency and reduced costs. SaaS is rapidly emerging as the dominant delivery model for meeting the needs of enterprise IT services. However, most enterprises are still uncomfortable with the SaaS model due to lack of visibility about the way their data is stored and secured. According to the Forrester study, ''The State of Enterprise Software: 2009,'' security concerns are the most usual cited reason why enterprises are not interested in SaaS. Consequently, addressing enterprise security concerns has emerged as the biggest challenge for the adoption of SaaS applications in the cloud.

In SaaS, the client has to depend on the provider for proper security measures. The provider must do

the work to keep multiple users' from seeing each other's data. So it becomes difficult to the user to ensure that right security measures are in place and also difficult to get assurance that the application will be available on demand times[7]. With SaaS, the cloud customer will by definition be substituting new software applications for old ones. Therefore, the focus is not upon portability of applications, but on preserving or enhancing the security functionality provided by the legacy application and achieving a successful data migration [20].

B. Security issues in PaaS

In PaaS, the provider might give some control to the people to build applications on top of the platform. But any security below the application level such as host and network intrusion prevention will still be in the scope of the provider and the provider has to offer strong assurances that the data remains inaccessible between applications. PaaS is intended to enable developers to build their own applications on top of the platform. As a result it tends to be more extensible than SaaS, at the expense of customer-ready features. This tradeoff extends to security features and capabilities, where the built-in capabilities are less complete, but there is more flexibility to layer on additional security.

Applications sufficiently complex to leverage an Enterprise Service Bus (ESB) need to secure the ESB directly, leveraging a protocol such as Web Service (WS) Security [17]. The ability to segment ESBs is not available in PaaS environments. Metrics should be in place to assess the effectiveness of the application security programs. Among the direct application, security specific metrics available are vulnerability scores and patch coverage. These metrics can indicate the quality of application coding. Attention should be paid to how malicious actors react to new cloud application architectures that obscure application components from their scrutiny. Hackers are likely to attack visible code, including but not limited to code running in user context. They are likely to attack the infrastructure and perform extensive black box testing. The vulnerabilities of cloud are not only associated with the web applications but also vulnerabilities associated with the machine-to-machine Service Oriented Architecture (SOA) applications, which are increasingly being deployed in the cloud.

C. Security issues in IaaS

With IaaS the developer has better control over the security as long as there is no security hole in the virtualization manager. Also, though in theory virtual machines might be able to address these issues but in practice there are plenty of security problems [3,9]. The other factor is the reliability of the data that is stored within the provider's hardware. Due to the growing virtualization of 'everything' in information society, retaining the ultimate control over data to the owner of data regardless of its physical location will become a topic of utmost interest. To achieve maximum trust and security on a cloud resource, several techniques would have to be applied [9].

The security responsibilities of both the provider and the consumer greatly differ between cloud service models. Amazon's Elastic Compute Cloud (EC2) [2] infrastructure as a service offering, as an example, includes vendor responsibility for security up to the hypervisor, meaning they can only address security controls such as physical security, environmental security, and virtualization security. The consumer, in turn, is responsible for the security controls that relate to the IT system including the OS, applications and data [20].

Security solutions

There are several research works happening in the area of cloud security. Several groups and organization are interested in developing security solutions and standards for the cloud. The Cloud Security Alliance (CSA) is gathering solution providers, nonprofits and individuals to enter into discussion about the current and future best practices for information assurance in the cloud (''Cloud Security Alliance (CSA) security best practices for cloud computing,'' 2009 [8] The Open Grid Forum publishes documents to containing security and infrastructural specifications and information for grid computing developers and researchers [16].

The best security solution for web applications is to develop a proper development framework that has tough security architecture. Tsai W, Jin Z, and Bai X, put forth a four-tier framework for web-based development that though seems interesting, only implies a security facet in the process [21]. ''Towards best practices in designing for the cloud'' by Berre, Roman, Landre, Heuval, Skar, Udnaes,

Lennon, and Zeid is a road map toward cloud-centric development [5], and the X10 language is one way to achieve better use of cloud capabilities of massive parallel processing and concurrency [19].

Krugel points out the value of filtering a packet sniffer output to specific services as an effective way to address security issues shown by anomalous packets directed to specific ports or services [13]. An often-ignored solution to accessibility vulnerabilities is to shut down unused services, keep patches updated, and reduce permissions and access rights of applications and users [13].

(Raj et al., suggest resource isolation to ensure security of data during processing, by isolating the processor caches in virtual machines, and isolating those virtual caches from the hypervisor cache[19]. Hayes points out that there is no way to know if the cloud providers properly deleted a client's purged data, or whether they saved it for some unknown reason [11].

Basta and Halton suggest one way to avoid IP spoofing by using encrypted protocols wherever possible[4]. They also suggest avoiding ARP poisoning by requiring root access to change ARP tables; using static, rather than dynamic ARP tables; or at least make sure changes to the ARP tables are logged.

Hayes points out an interesting wrinkle here, ''Allowing a third-party service to take custody of personal documents raises awkward questions about control and ownership: If you move to a competing service provider, can you take a data with you? Could you lose access to documents if you fail to pay a bill?''. The issues of privacy and control cannot be solved, but merely assured with tight service-level agreements (SLAs) or by keeping the cloud itself private [11].

One simple solution, which (Milne, 2010)[14] states to be a widely used solution for UK businesses is to simply use in-house ''private clouds'' (Milne, 2010)[14]. Nurmi, Wolski, Grzegorczyk, Obertelli, Soman, Youseff, & Zagorodnov show a preview of one of the available home-grown clouds in their (2009) presentation ''The Eucalyptus Open-Source Cloud-Computing System''[15].

Conclusion

In this paper, we discuss a fresh and demanding technology: cloud computing. its definition and some existing issues in different service models of cloud discussed. Cloud comes with great advantages to help with economic growth, such as supporting the green agenda, reducing operational man-power, and providing effective utilization of resources, But still there are some challenges in cloud wich needs to be addressed, most important challenges are security and privacy, besides the legal issues and so on. if the cloud has a common security methodology in place, it will be a high value asset target for hackers because of the fact that hacking the security system will make the entire cloud vulnerable to attack. In such a scenario, if customized security is provided as a service to applications, it would make sense. Though there are many practical concerns regarding to dynamic security and data storage based on meta-data information we can concentrate on a way to derive a framework which targets these concepts and provide a practical solution. It is obvious that misunderstanding of some Cloud properties, and underestimating the challenges along with lack of organized academic studies of cloud are main obstacles for its rapid growth among people and organizations. There is no doubt that the cloud computing is the development trend in the future. To welcome the coming cloud computing era, solving the existing issues is a implicit steps forward.

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ICT and Civil Registration: Basic Service Delivery, National Impact

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Abstract

Civil registration refers to a regular process of recording events like birth, marriage, migration, divorce and death. The process has been carried out by local registrar office regularly. These events are registered and organized for different local and national level planning.ICT has changed the life style of every individual, society and government. An individual can easily access services of government through online and government can also provide 24X7 service delivery to its citizens. In Nepal, the process of civil registration is paper based and citizens have to present in front of local registrar office physically. The usage of ICT has made this world virtual. Likewise, the basic civil registration process could be online and organized these data for different sectors like education, grant distribution, population census, etc in local and national level. This paper explores online civil registration for quick service delivery and helps to design national identity card system.

Keywords:

ICT, civil registration, online, service delivery

Introduction

A child gets birth, grows up with lots of enjoyment and sorrows and finally dies. The process of recording full life cycle events like birth, marriage, migration, divorce and death of the child is known as vital events registration or civil registration. Each born child has right to birth registration at registration office where the event has occurred [8]. Civil registration plays a vital role in modern society, the civil status of each person giving them protection as well as protecting society as a whole [17]. It is a legal document and very much useful as a source of statistics for health planning and socio- economic development. It affects in the individual or family and the community or country. For the individual or family, the civil registration provides legal evidence of the birth which is necessary for proof of age, identity card, school admission, etc; and, legal evidence of death which is necessary for insurance claims, succession rights to property, family allowance, etc [1]. For administration of a public activity, it requires some form of registration. Since the work of the public administration mainly involves dealing with people, it is necessary to be able to identify such persons and gain access to general personal data like name, address, age, marital status, etc [9].

IT governance is defined as 'the framework for the leadership, organizational structures and business processes, standards and compliance to these standards, which ensures that the organization's information systems support and enable the achievement of its strategies and objectives'[18].

ICT has transformed the way in which people live, work and spend their money. Public sector organizations have focused their efforts towards digitalizing their services to their customers or citizens through the Internet so that users can easily use the available services from any place and at any time [16]. The developing countries have weak national identification (ID) and vital registration systems. The weaknesses in these systems can lead to two major issues in the provision of social security allowances and services. First, identification problems can result in exclusion from much-needed social security programmes, as eligible people are sometimes not able to register for government programmes. Next, the less capacity of governments to verify identities can also result in massive leakages. In both cases, weak systems can lead to undesirable outcomes for well-designed programmes [20].

Digital technology is a part of people's daily lives and has been more pervasive, local government needs to explore prospective of digital technologies in innovative ways to provide services to its citizens [6]. With proper use of ICT, it increases efficiency, speed, and transparency in service delivery. It also assists in generation and dissemination of knowledge [2]. Service delivery is an essential function in relation between government bodies and citizens. It is a part of complex relation between government, society and citizens. The government as a key public service provider, citizens has a right to demand quality services fast, easy at moderate cost. The image of government depends on service delivery with quality services at affordable price to its citizens [5]. Effective public service delivery is one of the key parameters to measure the goodness of governance. Therefore, government should be willing to formulate new strategies for effective public service delivery [13].

Statement of the problem

In Nepal, civil registration process is carried out by local register at local level since three decades through manual process. Through manual process, civil registration service delivery couldn't be as effective as citizens' expectation. They have to present at local register office physically and have to wait in a long queue to get such services.

Objectives

The main objective of this research work is to explore online civil registration for quick and better service delivery to citizens.

Literature review

Business processes refer to the set of logically related tasks and behaviors that organizations and society develop over time to produce specific business results and the unique manner in which these activities are organized and coordinated [7]. Public service is all activities that are delivered by the government to fulfill daily needs of society and peoples' daily life [3]. A local government is more responsive to citizens' day to day activities. Therefore, the capacity of local government has to be improved for guarantee on continuity of regular service delivery. The local government is more responsible for basic services in many social areas such as education and schooling, social security and basic provisions, legal protection, housing, etc. The educational level of people is increasing and with that their capabilities and expectations are also increased [5]. The mechanism of service delivery of local government has not been changed for decades [2]. Through the proper utilization and implementation of technology and digital tools, the service delivery of local government could be more effective and challenges could be minimized [6].

Interaction between citizens and local government can be occurred in different ways such as providing information through government websites, local media, special publication, information desks, etc [5]. Information dissemination is an important function of local government for the transparency as well as effective service delivery [12]. ICT is a potential tool of efficient public service delivery. It offers new possibilities for communication between people and organization and increases the quality and quantity of interaction with people. It enhances the transparency and access to organization [13]. There are several functions like electronic access, electronic authentication, unequivocal numbers, basic registration and information exchange that occurs between citizens

and local government can be directly facilitated by the new information technology. With the implementation of ICT-enabled public service delivery, it improves access to public services, increases efficiency, transparency and accountability of government [5]. The rapid development of ICT has helped in exploring new opportunities for service delivery and income generation [10].

Business firms invest heavily in information systems to achieve six strategic business objectives: operational excellence; new products, services, and business models; customer and supplier intimacy; improved decision making; competitive advantage; and survival [7]. The basic elements for successful service delivery as mentioned by [3] are:

i. Friendly interface with service seekers

ii. Sustain communication

iii. Set expectations

iv. Process and organisation re-engineering

v. Build staff capability to deliver services

vi. ICT as a key enabler

vii. The legal foundational structure

viii. Dedicated institutional structures

ix. Continued monitoring and evaluation

The advanced technologies have huge potential for delivering prompt, efficient and high quality services to vulnerable, poor and needy population of society [14]. The contribution of IT to service delivery is particularly visible in web services, computing services, business intelligence services, and information technology infrastructure [15]. The rapid growing application of ICTs and their subsequent use on strengthening interaction among public entities, civil societies, communities and citizens has given rise to a new governance paradigm known as e-Governance [4]. E-Governance is widely accepted as an effective tool of service delivery by all developed countries and developing countries. It facilitates the service delivery of government to citizens in simple, speed and convenient way. Besides, it improves efficiency in administration, brings about transparency and reduction of government cost [13]. IT-enabled service delivery can be seen in diverse fields such as healthcare, travel, retailing, media, and entertainment. The depth and the diffusion of technology are helping to accelerate the application and use of knowledge in different ways [15].

The benefits of e-Governance are transparency and openness, reliability and predictability, accountability, efficiency and effectiveness [14]. In addition to improving delivery of government services, e-government makes government operations more efficient. It also empowers citizens by providing easy access to information and easy communication with other citizens. For example, citizens in some states can renew their driving licenses or apply for unemployment benefits online [7]. E-governance plays significant roles in the improvement of public service delivery [13]. They are:

Increases efficiency by automation

1. Supports effective decentralization in decision making
2. Increases account ability of the public service agencies to citizens
3. Improves resource management.
4. Offers effective communication
5. Increases accessibility
6. Provides comprehensive data base
7. Facilitate strategic planning
8. Enables reduction of paper work with the use of E-mail and electronic data interchange
9. Supplies information related to the market

The continuous change in technology and its impact in business and societies have shown a huge importance of information management. As time passes away, competition increases and new businesses and industries appear in the market. Those firms are considered as successful who learn how to use the new technologies [7].

Developing countries have been using IT and ICT as potentially useful tools for social improvements as well as to improve efficiency of government services. Nepal is also extending its services to com-

municate with poor people and people of mountain regions [19]. With the help of ICTs, huge amount of information can be collected, stored, processed and disseminated to public through different means and media. This information is vital and beneficial to social protection scheme to become successful [14].

IT-enabled services can be delivered through computers, mobile devices, or by customer service personnel, regardless of the industry and manner of delivery. It seems clear that IT plays a role in the shift from product centric to service-centric business models, and in the creation of new opportunities for businesses [15]. Three interrelated changes have been mentioned in the technology area [7]. They are

i. Emerging mobile digital platform,

ii. Growth of online software as a service, and

iii. Growth in "cloud computing" where more and more business software runs over the internet.

The vital events records are very much important and critical to citizen and government also. These events play significant roles in many areas like monitoring social security cash transfer, census study, local and national level planning and so on [17].

Methodology

The research paper is based on field visit experiences of the researcher and adopted qualitative techniques through Focus Group Discussion (FGD). The researcher has visited Dadeldhura, Lalitpur, Kathmandu, Kailali, Illam, and Dang districts of Nepal and interacted with civil registration focal person, local registers and services seekers. Besides, civil registration act and regulations, related articles, case studies have been reviewed. The researcher working experience is also used. The researcher worked with Department of Civil Registration (DoCR) as Management Information System (MIS) Specialist for more than 4 years.

Proposed Framework

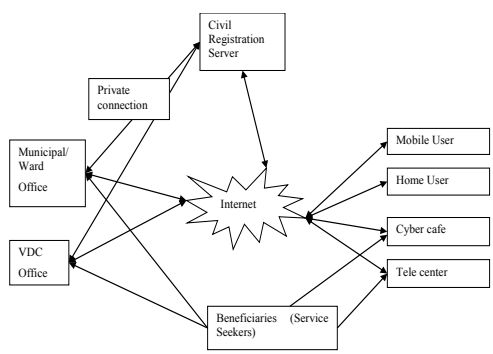
Based on the field visit and interaction with focal person and service seekers, this research has proposed web based application for online civil registration, which is shown in figure 1. A beneficiary (service seeker) may log in to service for civil registration and register his/her application through personal mobile or computer or may visit to nearby cyber cafe, tele-center or corresponding local register office. After successful registration, the beneficiary gets unique token number into personal mobile number. Now, the beneficiary may go to corresponding local register office, staff of local register office searchers the registered form based on the given token number and prints the form. After final verification from the beneficiary, the local register signs certificate and provides to the beneficiary. Hence, civil registration data is fully digitized and can be use for different local and national level planning. The data can be shared among different government identities as shown in figure 2.

Conclusion

Civil registration is a continuous and regular process that has been carried out by local register at local office. At local office, the process is carried out and records are managed manually. In modern age, technology has changed the process of service delivery from local to national level. Through the proper use of ICT and its applications, service delivery like civil registration could be quick, effective and efficient. Since birth registration is primary and compulsory for every individual, the unique number generated helps for different activities like education, health, social security programme, national identification card, etc.

Figure 1: Proposed framework for online civil registration

Figure 2: Civil registration data sharing among different government identities



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A Link Prediction Strategy for Personalized Tweet Recommendation Through Doc2Vec Approach

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Abstract

Abstract: Nowadays with growth of using Internet as a principle way of communication , likes different social medias channels (Twitter ,Facebook ,etc) and also access to huge amount of information like News , there appear a main research subject to help users to find his/her interests among vast amount of relevant and irrelevant information. Recommender systems are helped to handle information overload problem and in this paper we introduce our Tweet Recommendation System that implement user's Twitter information (Tweets , Retweet , Like , ...) as a source of user's information. In this work the semantic of tweets that regard as a User's Explicit Interests(e .g . person , events , product mentioned in user's tweets) are identified with the Doc2vec approach and recommend similar tweets through link-prediction strategy.

Keywords:

Personalization , Doc2Vec , Semantic Relatedness , Link-Prediction .

Introduction

Every day number of users , using social media have been increased and they create huge amount of data about their interests , everyday events , their friends and ... , which are so precious as a source of raw data to explore knowledge about them .The available data on these social networks is of great importance when mined and used for such purposes as analysis and prediction. Nowadays recommender systems are help users to find their own interest between this vast of information and items and also solve information overload. Recommender systems are a means of personalization providing their users with personalized recommendations of items that would possibly suit the users' needs. The main purpose of a recommendation system is to estimate the user's preferences and present him with some items that he doesn't know yet.

In general recommender systems are programs which attempt to predict items that users may be interested in.

Recommender systems are worked almost in a same way through different domains, which by using users historical interests or ratings , predict the items that user might like them. But in some specific domains like News , the story is different .

News are so timed depended and after short period of time their freshness are gone. So the news recommender system should be able to recommend fresh news as well as related to user interests.

People were followed news from different sources like old traditional way but nowadays the most common way that people read news are social networks channels that provide with people most recent and fresh news . One of the most famous social networks that focused in news is Twitter . Every user has profile in twitter and will follow different Channels, Celebrities or his / her friends . Since every user has many following pages , his / her twitter timeline has many relevant or irrelevant subjects which forced users to finding his interested news .

As a consequence, the role of user modeling and personalized information access is becoming crucial: users need a personalized support in sifting through large amounts of available information, according to their interests and tastes .

For this reason in this paper we study different users tweets for modeling users and introduce a framework for our tweet recommender system that semantically enriched each user tweets and detecting his / her interest and recommend to users some fresh and relevant news .

In this propose approach and in the first step we find user's explicit interests , User's profile build with implementing Doc2vec method on user's tweets After build each user's explicit profile based on Doc2vec models , similar user's are fined with similarity of theirs vectors and also we can find each similar semantic tweets.

Literature review

With the growing impact of the Social Web, or Web 2.0, on our everyday life, people start to use more and more different web based services like Facebook, Twitter, Flickr or blogs. They use these services to express their opinion, communicate with others and share pictures with friends. Thereby, they generate and distribute personal and social information like interests, social contacts, preferences and personal goals [14].

Twitter is an online social networking service that enables users to send and read short 140-character messages called "tweets". Registered users can read and post tweets, but those who are unregistered can only read them. Users access Twitter through the website interface, SMS or mobile device app.

As mention before, Twitter is one of the famous Content-Centric social network , which enables users to send and read short 140-character messages called "tweets". Due to the extensive usage of twitter, a large volume of text is being generated on a daily activity of users. Such a huge volume of user generated data had to be processed to utilize them effectively.

These data could be used in a variety of applications to enhance human life. For processing such huge amount of textual data, more advanced algorithms are required to learn the hidden patterns in the data. Text analytics is the method to process this huge corpus of unstructured text to get high quality data. [16]

Text Analytics is defined in Wikipedia as follows:

“Text Analytics describes a set of linguistic, statistical, and machine learning techniques that model and structure the information content of textual sources for business intelligence, exploratory data analysis, research, or investigation.”

A text analytics framework consists of three stages: Text preprocessing, Text representation and Knowledge discovery.

In text preprocessing , textual data that are produced by social media sites could not be analyzed directly because these are raw input texts. Preprocessing makes the text more consistent to facilitate the text representation.[16] For instance removing non-English words , transform all words to lower case , removing links and etc .

After preprocessing the input text, only significant words are present in the text. These words need to be represented as numeric vectors to make the analyzing easier. Vector space model or term vector model is an algebraic model for representing text documents

or any other objects as a vectors of identifiers . There are different methods in text representing such as Bag-Of-Word(BOW) , TF-IDF and Paragraph Vector that we used in our approach ,called Doc2vec.

The Word2vec and Doc2vec model and application by Mikolov et al. have attracted a great amount of attention in recent two years. The vector representations of words learned by Word2vec and Doc2vec models have been shown to carry semantic meanings and are useful in various NLP tasks[17]. As mentioned before we used Doc2vec model to represent each tweets.

Paragraph Vector is an unsupervised framework that learns continuous distributed vector representations for pieces of texts. The texts can be of variable-length, ranging from sentences to documents. The name Paragraph Vector is to emphasize the fact that the method can be applied to variable-length pieces of texts, anything from a phrase or sentence to a large document.[18]

In Bag of words approach, the text is divided into words. This process is called as tokenization. The structure of the text is not maintained in this approach. Each word is represented as one single variable with different numeric weights. TF-IDF (Term frequency/Inverse Document frequency) is commonly used as the weighing mechanism. In string of words approach, sequence of the words is maintained. In most applications, Bag of words is used due to its simplicity . [16]

Once the textual data are transformed into numeric vectors, machine learning or data mining algorithms could be used to identify hidden patterns in the text. The most common approaches followed are classification and clustering. Clustering fall under the category of unsupervised learning and classification falls under the category of supervised learning. In unsupervised learning, training data are not required. The documents which contain the textual data are segmented into different partitions such that each partition belongs to a single topic. This process is termed as clustering. In supervised learning, training data are required to make a machine learning method to learn a classifier to classify unseen data. Classification is used in various applications like news filtering, document organization and retrieval, opinion mining, email classification and spam filtering [16].

Related work

One of the most viewed social network channel is Twitter . Twitter pose a question to its users "What is happening?" and user can answer to this question in 140 characters [19] .

In twitter user have different opportunity to demonstrate their mine like : post tweet or update their following post or re-tweet them . Users can also using different Tags to show their feeling.

Although tweets may contain precious information , many of them have no relatedness to the users. This can annoy users to find their own interests between big amount of information . To this end , different work have been accomplished to response to this challenge .

In [20] the propose approach classified web pages by calculating the respective weights of terms. The user interest and preference models are generated by analyzing the user's navigational history. The similarity between Web content and the user's models is used to determine whether the content will be provided to the user. A user's navigational data is monitored and analyzed to conduct user modeling. An automatic classification method is utilized to categorize the Web contents browsed by a user.

In the proposed Web page classification method, the terms are determined by the ontology base WordNet (Miller 2009), and the weights of terms are calculated by the TF-IDF (term frequency–inverse document frequency) method .

Some others researcher work on the hybrid approach of recommendation , like [21] that propose a new methodology for recommending interesting news to users by exploiting the information in their twitter persona which model relevance between users and news articles using a mix of signals drawn from the news stream and from twitter : Profile of social neighborhood of the user , Content of their own tweet stream , Topic popularity in news and in the whole twitter-land .

In [22] the main focus is on the dynamic recommendation system that mentioned to have a successful recommendation system for active users , we should introduce ‘‘somewhat novel’’ articles to users. In this work by combining long-term interest of user with short-time interest , recommending a

novel news to users.

The inspiring research is [23] which present a content- based approach to modeling user interests based on Twitter . Personalization techniques are often classified into one of two categories: explicit and implicit. Explicit personalization requires active and conscious data entry from the user, such as through a series of checkboxes or rating devices. In contrast, implicit personalization aims to automatically learn user preferences. Content-based approaches typically monitor the behavior of a user in the scope of an individual site or system and make recommendations based on their historical behavior.

In general, implicit personalization is considered more desirable from a user experience perspective because it does not burden users with data input tasks.

In the other hand some other researcher work on the semantic of the tweets created by the users . Semantic relatedness, which computes the association degree of two objects such as words, entities and texts, is fundamental for many applications. It has long been thought that when human measure the relatedness between a pair of words, a deeper reasoning is triggered to compare the concepts behind the words.

In [24] investigate this question and introduce a framework for user modeling on Twitter which enriches the semantics of Twitter messages (tweets) and identifies topics and entities (e.g. persons, events, products) mentioned in tweets .

In other work [25] investigate semantic user modeling based on Twitter posts which introduce and analyze methods for linking Twitter posts with related news articles in order to contextualize Twitter activities.

While many semantic relatedness researches in the past utilized lexical databases such as Word Net and Wikitionary, the recent word embedding approaches have demonstrated their abilities to capture both syntactic and semantic information. In [26] mentioned that Among the embedding representations, Word2Vec and GloVe are widely adopted for many researches. However, word senses are not disambiguated in the training phase of both Word2Vec and GloVe. That affects the measurement of semantic relatedness. On the other way round, Word Net and Wikitionary are well-structured ontology that provides senses of each word. Their approach was to combined Word2Vec and GloVe with the lexical database Word Net is proposed for measuring semantic relatedness.

[27] demonstrate that By converting words and phrases into a vector representation, word2vec takes an entirely new approach on text classification. Based on the assumption that word2vec brings extra semantic features that helps in text classification, our work demonstrates the effectiveness of word2vec by showing that tf-idf and word2vec combined can outperform tf-idf because word2vec provides complementary features (e.g. semantics that tf-idf can't capture) to tf-idf.

Methods

In Figure 1) architecture of our proposed approach is showed and we describe how this system worked together. Then we describe each part of this respectively .

The Architectural design for the proposed approach consists of the following stages:

- Content Gathering:
    - Use Twitter API
- User modeling:
    - Tweet Preprocessing
    - Tweet Representation
    - Building Explicit user's profile
    - Building User Explicit Graph
- Recommendation Task

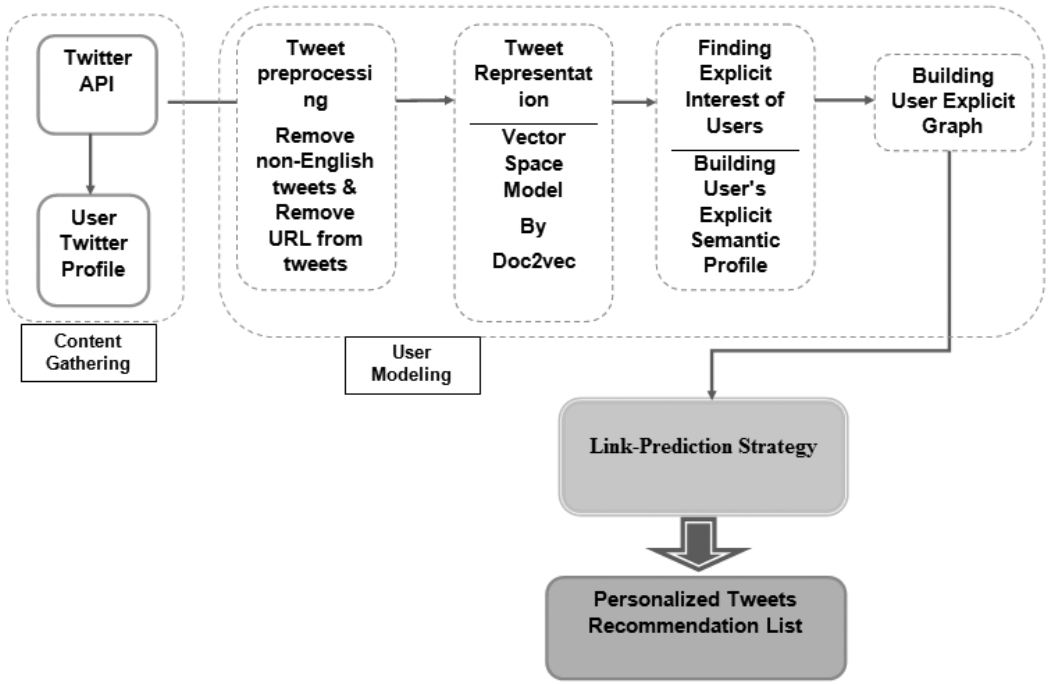

Figure 1 - Architecture of proposed approach

In Content Gathering step , Twitter provides many REST APIs to acquire data from Twitter using screen name. Using the "user_timeline" API , tweets from a particular user is acquired. This API takes many parameters as input. Screen name and number of tweets are two important parameters required to acquire a certain number of tweets from a particular user. Using this API, tweets for all the users in all the categories are acquired and stored in a file. Tweets , which are collected in the previous step cannot be used to train the classifier directly. Because these textual data contain some unwanted text. In preprocessing, these unwanted symbols and meaningless words are removed from the original tweet.

Most Tweets contain URLs, links, special symbols, abbreviations, hashtags, mentions and incorrect spellings[16]. The following rules have been followed to preprocess the tweets:

Rule 1: Remove all special characters except "#" and "@"

Tweets express emotions. So people use special characters to express their emotions. So all these special characters are replaced with null characters. "Hashtags" are the keywords in the tweets followed by the "#" symbol (e.g. #SuperBowl). Many users would be using the same hashtag for a particular event. So these hashtags are retained in the tweets. @ Symbol is used to specify the username. This is being handled by Rule 2.

Rule 2: Remove all URLs and @mentions

Shortened URLs are used in tweets. These URLs do not provide much information for us. For example, consider this shortened URL "bit. ly/12Jkw6U". These URL strings do not contain much text to predict the category. So these shortened URLs are removed from the text during preprocessing. "@" symbol is used to specify a screen name of a user in the tweets (e.g. @BarackObama). The words prefixed with "@" symbol is called as "mentions". These words cannot be used to predict the category of the tweet. Because these words usually contain only user name.

Rule 3: Convert all words to lower case

Tweets are written in an inconsistent format. All the characters in the tweets can be either capital or small or mixed. To make the training data more efficient, all the words in the tweets are converted to lower cases. In the Representation step , The vector representations of words learned by Word2vec and Doc2vec models have been shown to carry semantic meanings and are useful in various NLP tasks[17]. As mentioned before we used Doc2vec model to represent each tweets.

Paragraph Vector is an unsupervised framework that learns continuous distributed vector representations for pieces of texts. The texts can be of variable-length, ranging from sentences to documents. The name Paragraph Vector is to emphasize the fact that the method can be applied to variable-length pieces of texts, anything from a phrase or sentence to a large document[18].

Paragraph2Vec, which can be called in many names such as Doc2vec, paragraph vector or sentence embedding, is the algorithm that was modified from Word2Vec. The main purpose of Doc2Vec is associating arbitrary documents with labels, so labels are required. Doc2vec is an extension of word2vec that learns to correlate labels and words, rather than words with other words. In Figure 2 , the abstract of Doc2vec is demonstrated.

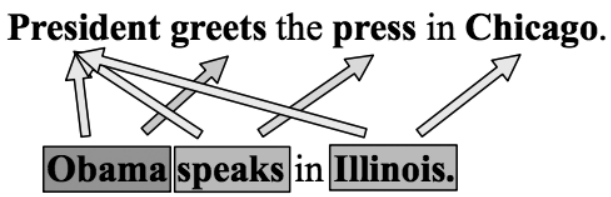

Figure 2 - Doc2Vec

After preprocessing and represent the tweet as vector ,we can find explicit interest of user's through the tweet's he/she were post or retweet or like . User's have their own tweets and similarity of user's can find through Doc2vec similarity function , which Doc2vec similarity function is cosine-similarity by default. Cosine-similarity compute each user's vector with each other and find most-similar of each user.

Experiment

We user a graph based link prediction to build user explicit graph and infer explicit interest of user's to recommend similar tweets. Link prediction is the problem of predicting the presence or absence of edges between nodes of a graph. There are two types of link prediction: (i) structural, where the input is a partially observed graph, and we wish to predict the status of edges for unobserved pairs of nodes, and (ii) temporal, where we have a sequence of fully observed graphs at various time steps as input, and our goal is to predict the graph state at the next time step [29].

The underlying graph of our proposed approach use three type of information : user's relationship with each other , user's relationship with tweets and tweet's relationship with each other.

Base on [30] our underlying representation for user model can be formalized as follow :

The representation model $G = (G_U, G_T, G_{UT})$ is a heterogeneous graph composed of three sub graphs , G_U, G_T and G_{UT} . $G_U = (V_U, E_U)$ is unweighted and undirected , which represents similarity between users base on the Doc2vec model . $G_T = (V_T, E_T)$ denotes potential similarity between all tweets base on the Doc2vec model.

$G_{U,T} = (V_{U,T}, E_{U,T})$ represents similarity between each user and other tweets base on the Doc2vec model.

The proposed approach in this paper is implemented in Python and run under Windows platform . We perform our experiment to answer this question : Is the hybrid approach has a better performance than implementing the explicit approach and implicit approach independently .

Dataset

In this proposed approach we collected our tweets dataset from Twitter using Twitter's API . The first ste p to using Twitter's API is to be authenticated by Twitter. After registered the application in Twitter , the following parameters are provided to access the Twitter to collect tweets : Consumer token , Consumer secret key , access token and access secret key .

We used this parameters to get tweets through using Python Twitter library called tweepy . We collect our data set from timelines of followers of most visited pages in Twitter (such as bbctech , bloomberg , espn , f1 , microsoft , newyork times , washington post , cnni , euronews and etc) . for each channel we collect the follower of that channel user's id and take that user's id to extracted his/her timelines tweets.

We crawled over 900 user's and 160,000 tweets . Twitter constrains that for each user , we can only crawl his/her last 3200 tweets . However this is sufficient for our experiment .

To generate the dataset , we use Sqlite as our data warehouse . All extracted tweets are went to the preprocessing step , which remove all URL , Non-English words , remove all @(mention) and transform all words to lower case. In the next step , we illustrate how to implemented Doc2Vec on tweets and user's profile .

After preprocessing step , to represent each tweets as a vector , we implemented Doc2Vec model on tweets dataset . We build a JSON file which contain all tweets and in each line the file look like this ("Tweet-Id" , "Tweet-text") . Doc2Vec model was trained in this data set which the label was tweet-id.

Tweet-Tweet graph

In our proposed approach the Doc2Vec features are as follow ,size of 35 and windows of 5.

The result is similar semantic tweets with their tweet-id and similarity degree. This tweet's Doc2vec model is used to build *Tweet-Tweet graph* as mentioned in recommending task. We collect 30 most similar tweets for each tweet , to build the link between tweets in graph.

User-User graph

After training all tweets through Doc2Vec model , to find similarity between users we should trained all user. To evaluate our proposed approach , we collected 100 active user ,whom at least posted 400 tweets .TO predict our proposed model accuracy , we implement Cross-Validation .Cross validation is mainly used in settings where the goal is prediction, and one wants to estimate how accurately a predictive model will perform in practice. In a prediction problem, a model is usually given a dataset of *known data* on which training is run (*training dataset*), and a dataset of *unknown data* (or *first seen* data) against which the model is tested (*testing dataset)*. Cross validation has different types but in our approach we implement Leave-p-cross-validation. Through used Cross-validation , remove randomly 30% of tweets from all collected user's tweets ,which they were liked or retweet by user to test our approach and the other user's tweets are used to trained our user's explicit model.

The Doc2Vec model build on this 100 users .The user's Doc2Vec model input is a JSON file , that the format look like this ("User-Id" , "All user's tweet") . Doc2Vec model was trained in this data set which the label was user-id.

The result is similar semantic users with their user-id and similarity degree.

This user's Doc2vec model is used to build *User-User graph* as mentioned in recommending task. We collect 30 most similar users for each user , to build the link between users in graph.

User-Tweet graph

After building *user-user* and *tweet-tweet* graphs , it's time to build *user-tweet* graph .To this end , we model all tweets and collected user with each other through Doc2Vec . The result is similar semantic tweets for each user. We collect 30 most similar tweets for each user , to build the link between user and tweets in graph.

Explicit recommendation

To build explicit profile of user we should build $G = (G_U, G_T, G_{UT})$ which contains of *user-user* graph , *tweet-tweet* graph and *user-tweet* graph . After build the G graph , the recommendation will build based on the link-prediction strategy . Our problem is to infer whether a user u is explicitly interested in tweet t . In other words , we are going to find missing links by adopting an unsupervised link prediction strategy over links in G Most of unsupervised link prediction strategies either generate scores based on vertex neighborhoods or path information [30]. Vertex neighborhood methods are based on the idea that two vertices are more likely to have s link of they have many neighbors in common. Path-based approach consider all paths between two vertices . All these approaches are based on a predictive score function for ranking links that are likely to occur. There is no single superior approach and the structure of the specific graph indicate their quality . In our approach we used Jaccard's Coefficient strategy for inferring explicit interests of a user .

The Jaccard's Coefficient is defined as follow:

$$\text{score(x,y)} = \left|\Gamma(x) \bigcap \Gamma(y)\right| / \left|\Gamma(x) \bigcup \Gamma(y)\right|$$

The explicit profile of a user is link between tweet t and user u ,which the link is computed through

the link-prediction approach (L):

If $U = \{u_1, u_2, ..., u_n\}$, $u_i = \{tweet_{1ui}, tweet_{2ui}, ...\}$ and $T = \{t_1, t_2, ..., t_n\}$:

The explicit profile of a user is :

$$E(u) = \{u, L(u,t) / t \in T, u \in U\}$$

Evaluation and metrics

To handle information overload and helping users to find items based on their interests , some kind of personalization techniques are used in personalized recommender systems. To figure out , that how much recommended items are suited and relevant to users , we should test and evaluate our propose recommender system.

The main question is a recommender system efficient with respect to a specific criteria like accuracy , user satisfaction , response time , serendipity or do in some other domain , do customer like/buy our recommended items ? .

Three typical measures which are used for evaluating the performance of the recommender systems are :Precision , Recall and F-measure. In information retrieval contexts , precision and recall are defined in term of set or retrieved documents and a set of relevant documents .

For classification and recommendation tasks , the term true positives , true negatives , false positives and false negatives compare the results of the classifier or recommender under test .These for outcomes can be define in Contingency matrix as follow in figure 3) :

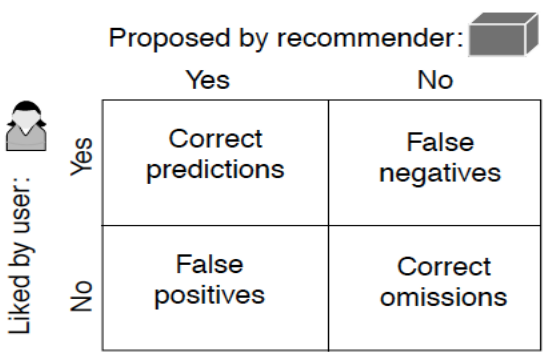

Figure 3 - Contingency matrix

The three performance measures are defined in Equation 1, 2 and 3 :

$$(1) \quad precision(p) = \frac{TP}{TP + FP}$$

$$(2) \quad recall(R) = \frac{TP}{TP + FN}$$

$$(3) \quad f - measure(F1) = 2 * \frac{P * R}{P + R}$$

In our proposed approach , we evaluate the results through these three measurements and compare each model based on Precision , Recall and F-measure . But the point is that in most situations, the system outputs a ranked list of recommendations rather than an unordered set. To this end , in modern information retrieval , precision and recall are not longer a meaningful metric , as many queries have thousands of relevant documents. Precision at k documents (P@K) and Recall at k documents (R@K) are meaningful and useful metrics (e.g.,p@10 corresponds to the number or relevant results on the first search results page) .

P@K proportion of top-k documents that are relevant and R@K proportion of relevant documents that are in top-k. If we don't know what value of K to chose, we can compute and report several:{5,10,15,20,15,30}

In our evaluation we test our recommendations in different K and find out that in K=30 , the recommendation results are better based on precision and recall @ K=30 . The results of recommendation @ k shown in Table 1 .

Table 1 - Recommendation Evaluation

Method	P@k=30	R@k=30	F1 @K=30
Explicit	53 %	56 %	54.4%

The evaluation results show that in k=30 the proposed personalized recommendation system has a better performance . Detail of three recommendation evaluation metrics diagrams are show in figures 4 ,5 and 6.

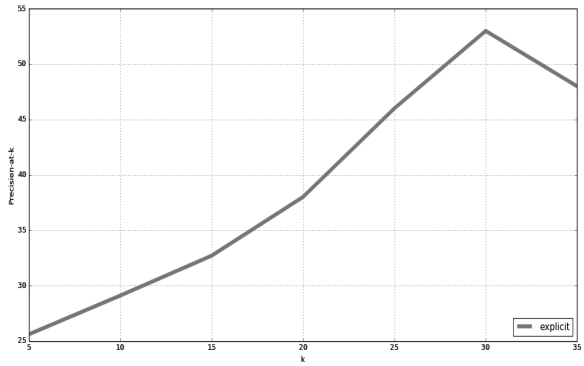

Figure 4 - Precision@k

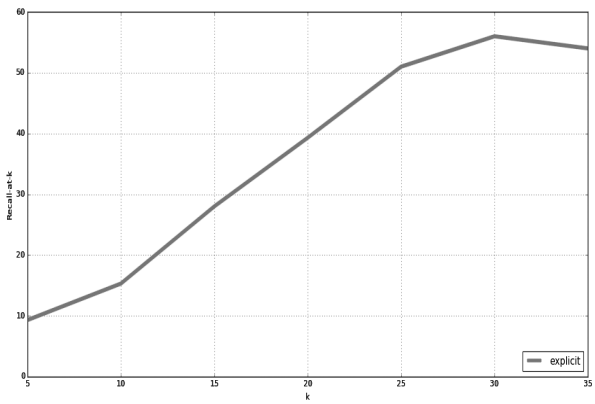

Figure 5 - Recall@k

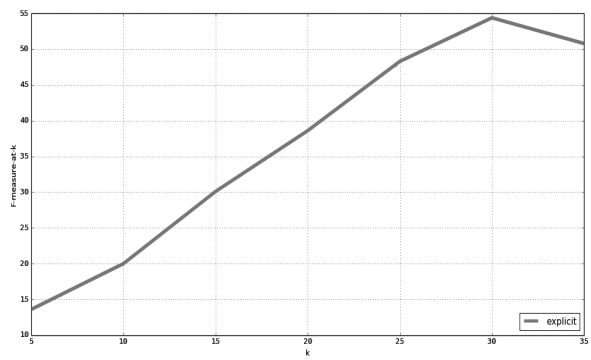

Figure 6 - F1@k

Conclusion and Future Work

To response the information overloading through internet and help users to find their interested items among these crowed of relevant/irrelevant information , recommender systems have appeared . In this paper , introduce history of recommender systems and different kind of them , like Content-Base recommender system , Collaborative recommender system and Hybrid recommender system . Also , in social media domain , focus on Twitter , which in this research is the main source of information for our proposed personalized recommender system . The next domain, is Text analysis which in text processing step and in representation we used Doc2Vec model. All tweets represent as an words vector . For represent tweets as a vector, in preprocessing step , all links and non-useful symbols and non-English tweets are removed and also convert all words to lower case. We recommend similar tweets for each user's based on his/her interests through Link-Prediction strategy and the result show that in k=30 the proposed approach has a better performances. For future work, to regard in this matter that user's interests are changed through passing time, with adding user's short-term interests and build a dynamic personalized recommender system, have a better personalized recommendation for each user.

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Selecting Technology Acquisition Strategy through Applying PROMETHEE Method: An Industrial Automation Equipment Manufacturer

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Abstract

Selecting the proper acquisition strategy for needed technologies, is one of the key strategic decisions in formulating technology strategy for a company. There are a number of factors were found to be influential in the selection of technology acquisition strategy. This paper deals with selecting technology acquisition strategy as a multiple criteria decision making (MCDM) problem. The proposed solution to the problem in this paper is the PROMETHEE method. In this paper, after depicting Technology Tree for a given product and selecting a Strategic Technology Unit (STU), PROMETHEE method was employed for selecting the best strategy for acquiring required technology based on several criteria such as: Cost, Time, Learning, Current Capability and Competitive advantage. A case of an industrial automation equipment manufacturer named Geshm Voltage is presented for the illustration of the our proposed approach. The proposed approach is expected to effectively help decision making on which strategy is adopted for acquisition of required technologies.

Keywords:

Technology Strategy, Technology Acquisition, PROMETHEE, Industrial Automation Industry, Qeshm Voltage

Introduction

Effective formulation and implementation of technology strategy has been considered as a major driver for competitive advantage of a company [1,2]. Although much debate is still going on about how to define the scope of technology strategy, from quite specifically focusing on technology development, to very broad knowledge-based definitions [3], what the literature has in common is that technology strategy can be viewed as a process composed of a series of steps requiring strategic decisions and actions, such as acquisition, management and exploitation [4,5,6]. One of the critical strategic decisions in formulating technology strategy is how to acquire the required technology. Technology acquisition concerns whether to acquire technologies through internal development, cooperating with other firms of institutions, or purchasing the technology [7]. A variety of technology acquisition strategies available and the complexity of modern business environments have led the decision to be intractably difficult [8].

Several empirical studies have been conducted to identify key factors affecting the selection of technology acquisition strategy [9,10,11,12]. Various approaches, based on mathematical programming, statistical analysis, or multiple criteria decision

making (MCDM) methods have been proposed to aid decisions both prior to and posterior to selection of technology acquisition mode: selection of technologies to be acquired among identified alternatives, such as technology selection [13], R&D project selection [14], and decisions under the selected acquisition mode such as technology supplier selection [15], go/no-go decision of R&D projects [16], identification of core technologies [17,18]. However, very few systematic approaches have been proposed to selection of technology acquisition strategy.

This paper deals with the selection of technology acquisition strategy as a MCDM problem. In MCDM, decision makers evaluate several alternatives using multiple conflicting criteria. The decision environment of selecting technology acquisition strategy constitutes a typical form of the MCDM [8]: selecting the appropriate option among several technology acquisition strategy as alternatives by considering various influential factors as criteria. Among a variety of MCDM methods, PROMETHEE[1] is employed in the proposed approach. In this paper, after depicting Technology Tree for a given product (HMI[2] system), PROMETHEE method was employed in order to select the best strategy for acquiring a Strategic Technology Unit (STU) based on several criteria including: Cost, Time, Learning, Current capability and Competitive advantage. A case of an industrial automation equipment manufacturer named Geshm Voltage is presented for the illustration of the proposed approach. The remainder of this paper is organized as follows: Section 2 reviews the PROMETHEE method steps and its application in previous studies. The proposed approach is explained in Section 3 and illustrated with the case of Qeshm Voltage company in Section 4. The paper ends with conclusions and suggestions in Section 5.

PROMETHEE

PROMETHEE is one of the most popular outranking method introduced by Roy [19]. Also, PROMETHEE is a MCDM method developed by Brans and Vinke [20]. In this method, the intensity of the preference for alternative "a" over alternative "b" with regard to each criterion "j" is measured in terms of a preference function Pj(a, b), which is evaluated based on the generalized criterion for each "j". Brans et al. proposed the following six possible types of generalized criterion [21]:

- *Type I (usual criterion):* It is a basic type without any threshold and very seldom used.
- *Type II (U-shape criterion):* It uses a single indifference threshold, which is generally used with qualitative criteria.
- *Type III (V-shape criterion):* It uses a single preference threshold and often it is used with quantitative criteria.
- *Type IV (level criterion):* It is similar to U-shape but with an additional preference threshold and it is mostly used with qualitative criteria.
- *Type V (V-shape criterion with indifference threshold criterion)*: It is similar to V-shape but with an additional indifference threshold and often used with quantitative criteria.
- *Type VI (Gaussian criterion):* It is seldom used.

In order to define these criterions and evaluate the preference functions, one or two of the following thresholds have to be fixed [22]:

- *Indifference threshold (q)*. It is the lowest value of dj(a, b) below which the decision maker considers, there is indifference between "a" and "b".
- *Strict preference threshold (p)*. It is the lowest value of dj(a, b) below which the decision maker considers, there is a strict preference of "a" and "b".
- *Standard deviation (s)*. It is a well-known parameter directly connected with standard deviation of a normal distribution.

A weighted average of the preference functions is calculated to obtain a rank ordering of the alternatives. "PROMETHEE I" provides a partial pre-ordering of the alternatives through a pair-wise dominance comparison of positive and negative outranking flows, while, "PROMETHEE II" provides a complete pre-ordering through a comparison of net outranking flows [22,23]

1 Preference Ranking Organization Method for Enrichment Evaluation

2 Human Machine Interface

A review of literature on PROMETHEE revealed that it has received wide attention and has been applied in diverse areas including: nuclear waste management [24], location selection [25], advanced manufacturing technology [26], water resources planning [27], environmental assessment [28], information system planning [29], Information technology as a national strategy [30], stock trading [31], supplier evaluation and management [32], and selection of lean manufacturing system [22] and lean improvement of the chemical emissions of motor vehicles [33].

The proposed approach

This section develops a proposed approach for selection of technology acquisition strategy. The goal of this proposed approach is to select the best option for acquiring the required technology among the alternative strategy. Our proposed approach consist of five steps including (Figure 1): 1-Selecting a product based on company strategy; 2- Depicting Technology Tree for selected product; 3- Selecting a Strategic Technology Unit (STU) as a key component or part of selected product; 4- Establishing decision matrix base on identified alternatives and criteria; 5- Applying PROMETHEE method in order to select best technology acquisition strategy for selected STU.

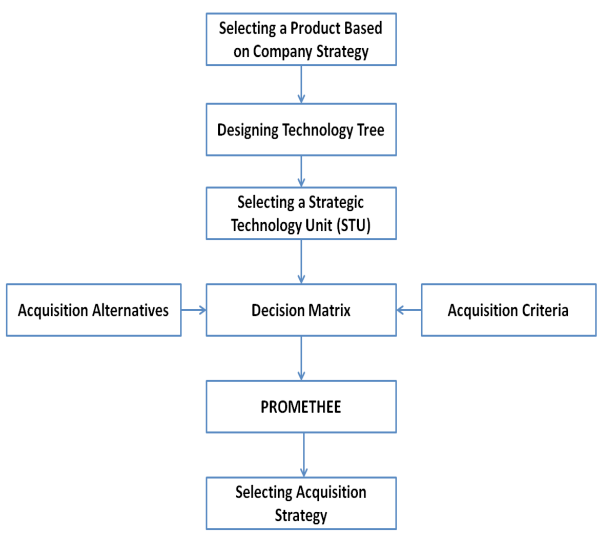

Figure 1. Proposed Approach for Selecting Technology Acquisition Strategy

Case illustration and results

The proposed approach was applied to select technology acquisition strategy in an industrial automation equipment manufacturer located in Iran named Qeshm Voltage. Over the last decade, the company has developed and provided a range of industrial automation equipment such as Programable Logic Controller (PLC), Flexible Manufacturing System (FMS) and etc. The company has decided to produce an advanced product named Human Machine Interface (HMI). The problem to be faced is how to acquire required technologies related to some strategic technology unites (STU). In the following, we illustrated all steps of our proposed approach in order to solve above-mentioned problem.

Depicting technology tree

Technology tree is a diagram that depicts all technologies, components and their functions in a specific product or system. Technology tree can help to making efficient and effective technology related decisions through facilitating the process of identifying and selecting key technologies [34]. Technology tree for HMI system was presented in Figure 2.

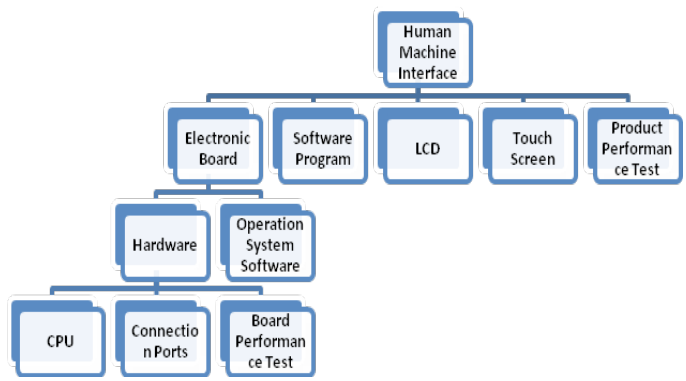

Figure 2. Technology Tree for HMI System

Selecting strategic technology unit (STU)

At first, STU was defined as the technologies embodied in a certain product and its production process by Hax and Majluf [35], but later it was considered as the skills and disciplines that are applied to the firm's products and processes in order to gain technological advantages [36]. In other words, STU is a key and critical technology in a given product or system. In our case and based

on company's managers and specialists opinion, Operation System Software (OSS) was selected as a STU. In the following, all steps required for selecting technology acquisition strategy for OSS are explained.

Decision matrix

In order to establishing a decision matrix, several alternatives and criteria have to be identified based on the main problem. In general, a number of technology acquisition strategy are available, such as [7]:

- Acquisition (a company acquires another company in order to access a technology of interest)
- Merger (a company merges with another one that possesses a technology of interest, and a new company emerges from the two existing companies)
- Licensing (a company acquires a license for a specific technology
- Joint venture (a company establishes a formal joint venture with equity involvement and a third corporation is created, with a definite objective of technological innovation)
- Joint R&D (a company agrees with others to jointly carry out research and development on a definite technology, with no equity involvement)
- R&D contract (a company agrees to fund cost of R&D at a research institute or university or small innovative firm, for a definite technology)
- Alliance (a company shares technological resources with other companies in order to achieve a common objective of technological innovation without equity involvement),
- Consortium (several companies and public institutions join their efforts in order to achieve a common objective of technological innovation without equity involvement)
- Outsourcing (a company externalizes technological activities and then, simply acquires the relative output)
- Networking (a company establishes a network of relationship, in order to keep the pace in a technological discipline and to capture technological opportunities and evolutionary trends)
- In-house R&D (internal efforts done by company in order to acquire needed technology with company's budget and man powers)

In this paper we have considered three broad categories of the technology acquisition strategy as the alternatives of our proposed approach: Research and Development, Collaboration, and Purchasing. Also, the literature review was conducted to identify factors that need to be considered when evaluating the appropriateness of the acquisition strategy. Some Factors affecting the selection of technology acquisition strategy include: Research and development resources [37], Research and development manpower [10], Research and development experience [38,39], Acquisition urgency [4], Importance to a firm [39,40], Technology life cycle [41,42], Development cost [43], Easiness to imitate [44], Market size [45], Competitive intensity [37,39], Availability of external source and Quality of external technology [11].

In this paper, we have selected five main criteria including: Cost [43], Time [6], Learning [36], Current capability [10] and Competitive advantage [37]. Some of these criteria are quantitative like cost and time, while some of them are qualitative such as learning, current capability and competitive advantage. In addition, the mentioned criteria were classified in two categories including: direct (performance grows while measure increases) and indirect (performance grows while measure decreases). The decision matrix for our problem is shown in Table 1.

Table 1. Decision Matrix

		Decision Criteria				
		Cost (Indirect/ Quantitative)	Time (Indirect/ Quantitative)	Learning (Direct/ Qualitative)	Current Capability (Direct/ Qualitative)	Competitive Advantages (Direct/ Qualitative)
Alternatives	Research & Development	500,000 $	24 Mounts	5	2	5
	Collaboration	250,000$	12 Mounts	3	4	3
	Purchasing	1,000,000 $	6 Mounts	1	5	1

Applying PROMETHEE Method

In the following, PROMETHEE method steps are explained.

Choosing proper preference function

We chose V-shape preference function for cost and time as quantitative criteria, and U-shape preference function for learning, current capability and competitive advantage as qualitative criteria based on the guideline proposed by Routroy and Kodali [46]. U-shape and V-shape preference function are shown in Figure 3.

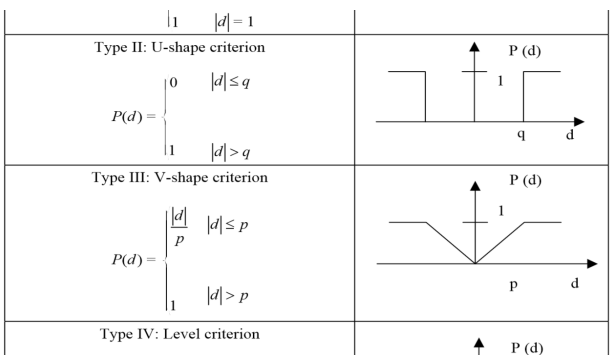

Figure 3. U-shape and V-shape Preference Function

Calculating the Preference Index

The preference index is defined as equation 1 [22]:

$$\pi(Ai, Ai') = \sum_j wjPj(Ai, Ai') \quad Equation\ 1$$

$$i = 1,2,\dots,m\,;\, j = 1,2,\dots,n$$

Where, Wj refers to the weight assigned to the criterion j and Pj(A1,A2) is represented as Pj[dj(A1,A2)]. Where, Pj(A1,A2) refers to the value of the preference function according to the difference between the evaluations of the alternatives A1 and A2 on the criterion j, where dj(A1,A2)=gj(A1)-Aj(a2). Preference Value of Each Alternative in Comparison to Other Alternatives are shown in Table 2. π (A1,A2) represents the intensity of preference of the decision maker of alternative A1 over action A2, when considering simultaneously all the criteria. It is a figure between 0 and 1 and:

- π(A1,A2)=0 denotes a weak preference of a1 over a2 for all criteria; and
- π(A1,A2)=1 denotes a strong preference of a1 over a2 for all criteria

Table 2. Preference Value of Each Alternative in Comparison to Other Alternatives

Criteria 1	Criteria 2	Criteria 3	Criteria 4	Criteria 5
V-Shape Preference Function	V-Shape Preference Function	U-Shape Preference Function	U-Shape Preference Function	U-Shape Preference Function
A1=24	*A1=500,000*	*A1=5*	*A1=2*	*A1=5*
A2=12	*A2=250,000*	*A2=3*	*A2=4*	*A2=3*
P1(A1,A2)=0	*P2(A1,A2)=0*	*P3(A1,A2)=1*	*P4(A1,A2)=0*	*P5(A1,A2)=0*
P1(A2,A1)=1	*P2(A2,A1)=1*	*P3(A2,A1)=0*	*P4(A2,A1)=1*	*P5(A2,A1)=1*
A1=24	*A1=500,000*	*A1=5*	*A1=2*	*A1=5*
A3=6	*A3=1,000,000*	*A3=1*	*A3=5*	*A3=1*
P1(A1,A3)=0	*P2(A1,A3)=1*	*P3(A1,A3)=1*	*P4(A1,A3)=0*	*P5(A1,A3)=1*
P1(A3,A1)=1	*P2(A3,A1)=0*	*P3(A3,A1)=0*	*P4(A3,A1)=1*	*P5(A3,A1)=0*
A2=12	*A2=250,000*	*A2=3*	*A2=4*	*A2=3*
A3=6	*A3=1,000,000*	*A3=1*	*A3=5*	*A3=1*
P1(A2,A3)=0	*P2(A2,A3)=1*	*P3(A2,A3)=1*	*P4(A2,A3)=0*	*P5(A2,A3)=1*
P1(A3,A2)=1	*P2(A3,A2)=0*	*P3(A3,A2)=0*	*P4(A3,A2)=1*	*P5(A3,A2)=0*

The preference index for each alternative was calculated and shown in below. We chose same weight (0.2) for all criteria.

(A1,A2)=0.2(0+0+1+0+1)=0.4π
(A1,A3)=0.2(0+1+1+0+1)=0.6π
(A2,A1)=0.2(1+1+0+1+0)=0.6π
(A2,A3)=0.2(0+1+1+0+1)=0.6π
(A3,A1)=0.2(1+0+0+1+0)=0.4π
(A3,A2)=0.2(1+0+0+1+0)=0.4π

Computing Positive and Negative Outranking Flows

Positive (where alternative is dominating) and negative (where alternative is dominant) outranking flows for each alternative were computed according to equations 2 and 3 [22]. Positive and Negative Outranking Flows are shown in table 3.

$$\varphi + (Ai) = \frac{1}{m-1} \sum_{Ai \in A} \pi(Ai, Ai') \quad i = 1,2,\dots,m \; ; i' = 1,2,\dots,m \qquad \text{Equation 2}$$

$$\varphi - (Ai) = \frac{1}{m-1} \sum_{Ai \in A} \pi(Ai', Ai) \quad i = 1,2,\dots,m \; ; i' = 1,2,\dots,m \qquad \text{Equation 3}$$

Table 3. Positive and Negative Outranking Flows

	A1	A2	A3	+ø
A1	-	0.4	0.6	0.5
A2	0.6	-	0.6	0.6
A3	0.4	0.4	-	0.4
-ø	0.5	0.4	0.6	

Computing the Net Flow

Net flow for each alternative can be computed by equation 4 [22]. The higher the leaving flow and the lower the entering flow, the better the alternative. The net flow for each alternative was computed and shown in below.

$$\varphi(Ai) = \varphi + (Ai) - \varphi - (Ai) \quad \text{Equation 4}$$

$$(A1) = 0.5 - 0.5 = 0 \; ø$$
$$(A2) = 0.6 - 0.4 = 0.2 \; ø$$
$$(A3) = 0.4 - 0.6 = -0.2 \; ø$$

Selecting Acquisition Strategy

Based on the results obtained from net flow of all alternatives, it 's clear that Collaboration, Research and Development and Purchasing have priority as technology acquisition strategy respectively. Considering the Figure 4, it can be concluded that Collaboration is the best strategy for acquiring OSS technology.

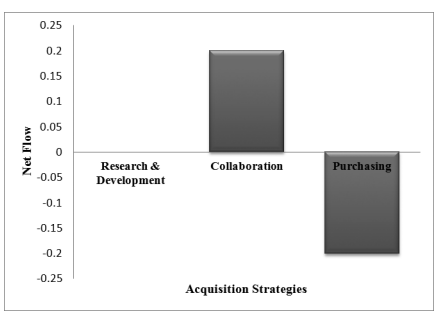

Figure 4. Net Flow of Each Alternative

Conclusion

This paper started with the following questions: how the managers or executives of a company have made a decision about technology acquisition strategy? What factors are influential on making such decision? Which alternatives are available in this kind of decision making process? What decision-making methodology the managers can used to make such decisions? A detailed step-by-step approach was presented in this paper including: 1) Selecting a product based on company strategy; 2) Depicting technology tree for selected product; 3) Selecting a strategic technology unit (STU) as a key component or part of selected product; 4) Establishing decision matrix base on identified alternatives and criteria; 5) Applying PROMETHEE method in order to select best technology acquisition strategy for selected STU. The proposed approach evaluates the appropriateness of alternative strategy for technology acquisition (Research and Development, Collaboration and Purchasing), in terms of Cost, Time, Learning, Current capability and Competitive advantage. The case of an industrial automation equipment manufacturer was presented for the illustration of the proposed approach. In current paper based on employing a proposed approach, we found that collaboration is the best strategy for acquiring OSS technology as a strategic technology unit embedded in HMI system. Also, it was shown that the PROMETHEE was successfully employed for producing the priorities of the alternative strategy. It is advisable to employ PROMETHEE method in order to select key technologies embedded in a product or process. In addition, future researches can apply this method in order to select best strategy among collaboration strategy like joint R&D, alliances, joint venture, consortium and etc.

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Ontological Map of Service Oriented Architecture based on Zachman Framework

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Abstract

Service orientation is an approach in the field of enterprise architecture, business information systems and software application that its main element is the service. Shared service is an organization model of sharing, across an organization. It enables collaboration among the functions/departments. Despite of the widespread use of these two approaches in information technology, there is no tool to optimize the management of them. The aim of this study is Ontological map of service oriented architecture based on zachman framework to adapt it in the reference enterprise architecture framework through implementation ontology views on system architect software and as well as equivalent ontology component with UML diagrams. After the implementation of the suggested model, the results showed that ontology is a formal description and explicit display of objects, concepts and other entities in the relationship between them. In other words, there is a model that describes all that is in fact in to understandable language for the system. Thus the proposed establishes have association between all aspects of zachman framework, also to create a clear description of business concepts in the management of shared services and is effective to provide a unified platform for enterprise modeling.

Keywords: Service oriented, Shared service, service management, ontology, zachman

Introduction

Service-oriented architecture is Strategic framework of technology that offers all inside and outside systems to give or receive a well-defined service [1]. In fact it is a standard framework that services built, deploy and run in it. And Aims to increase the agility of the information technology infrastructure to respond quickly to changes in business needs [2]. service-oriented architecture is an approach to design and implementation organization software by the means of communication between services that have the properties of loose coupling, coarse grains and are reusable [3]. In general, service-oriented architecture is an approach to organize and optimize distribution capabilities that territory under the control of the several owner and provides way to order, identify, use and interact with capabilities [4]. Service oriented architecture (SOA) and shared services (SS) are two correlated streams of research into the alliance of business and information technology [5, 6] .SOA deals with information architectures that support service oriented computing for on-demand business applications [7, 8, and 9]. SS, on the other hand, is the consolidation of common functions across multiple organizations to reduce information process duplication and increase information and knowledge sharing [10]. SS provide new impetus of business sourcing strategies in using information technology. Generally, accounting and financial management, human resources management, acquisition transactions, and

customer relation management are the designated lines of business processes for SS [11, 12, and 13]. Clearly, the major motivation for organizations to adopt SOA is to implement SS [14], and the major technology foundation for the implementation of SS is SOA [15, 16]. In spite of the close connection between SOA and SS, the two areas are distinct from each other in many aspects. Generally, research reports on SOA have been focusing more on computational technologies (e.g., cloud computing, virtual Web service networks, and software standards), while studies on SS have placed more emphasis on organizational business process management through applications of information technology. From the standpoint of information technology management, integration of the two subjects is imperatively needed to establish SS management (SSM) that supports the transformation of business process requirements into service-centric computing. In our definition, SSM refers to organizational activities that coordinate the efforts of shared services partners to accomplish desired goals and objectives using shared services efficiently and effectively. The information technology community has called for establishing multidisciplinary service science. One of the approaches that lead to a common understanding of the concepts and elements is enterprise ontology. Ontology comparing with structured, object-oriented and model driven, involve the explicit description of visual elements, components, and various concepts. Also provides integrate semantic context of existing concepts in the business domain for the users. An enterprise architecture framework, defines and organizes all kinds of information in a logical structure. The framework is a tool that helps us to think structural. According to the definitions and studies we find that researches that has been done in the field of service-oriented architecture often deals the identification and application of this type of architecture and models. In addition, the management of shared services with shared resources requires comprehensive and specific work. On the other hand, studies in the field of enterprise ontology often consider the fundamental issues and standards. Although there are gaps in the above-mentioned views that not able to cover interactions between humans and computers in service management properly and provide a way for regular users. In this article we have tried to present a different mapping than previous methods such as object-oriented model driven by combining two service-oriented and ontology so to recognize enterprise ontology position beyond a concept and push to effective mapping. In addition, mapping that links semantic perspective between all aspects and better management of shared services in the form of a systematic framework Since the subject of this study, is a combination of related issues to service-oriented architecture, shared services and ontology mapping, Similar research that focused simultaneously on these three elements haven't been identified by the author. The innovation of this study is to combine all three concepts of SOA, SSM and ontology that identify in the form of ZF to take Service Management. This study has six sections the first section includes an introduction, problem definition and the necessity of research is fully described above. The second section is devoted to the literature, concepts of service-oriented architecture, ZF, shared services and ontology are considered. Third section is about history of available techniques and previous works are described. The fourth section describes the proposed model of ontology mapping and we'll explain the method. In the fifth section presents a case study and the last section research result will be discussed.

Literature review

Enterprise Architecture

An organization has a set of different and distributed tasks. The organization includes numerous resources such as human resources, technology and related structure. Zachman, has been defined enterprise architecture as follow [17]: Enterprise Architecture Provides models in connection with the description of an organization so that conform to the requirements of management, produced and during its life is unmaintainable and changeable.

Servic-Oriented Architecture

Service-oriented architecture (SOA) is an approach used to create an architecture based upon the use of services. Services (such as Web services) carry out some small function, such as producing data, validating a customer, or providing simple analytical services.

Shared service

Shared Services is a way of organizing administrative functions to optimize the delivery of cost□effective, flexible, reliable services to all "customers". Shared services is the provision of a service by one

part of an organization or group where that service had previously been found in more than one part of the organization or group [18, 19] .Thus the funding and resourcing of the service is shared and the providing department effectively becomes an internal service provider.

Ontology

The word ontology is rooted in metaphysics and philosophical science that is used to describe the nature of being or existence. But in general ontology is defined as a clear description of the common mentality [20]. An ontology in a specific domain, includes a vocabulary of concepts and conceptual structure that defines the relationship between them. Ontology, in the field of information technology, defined in two ways:

- The ontology defines the terms and concepts by which we can describe the area of knowledge and displayed [21].
- Ontology is a mechanical engineering products, including specific words used to describe the reality and set of explicit hypotheses about the meanings of words [22].

Components

Common components of ontologies include:

Individuals- Instances or objects (the basic or "ground level" objects).

Classes- Sets, collections, concepts, classes in programming, types of objects, or kinds of things.

Attributes- Aspects, properties, features, characteristics, or parameters that objects (and classes) can have.

Relations- Ways in which classes and individuals can be related to one another.

Function terms- Complex structures formed from certain relations that can be used in place of an individual term in a statement.

Restrictions- Formally stated descriptions of what must be true in order for some assertion to be accepted as input.

Rules- Statements in the form of an if-then (antecedent-consequent) sentence that describe the logical inferences that can be drawn from an assertion in a particular form.

Axioms- Assertions (including rules) in a logical form that together comprise the overall theory that the ontology describes in its domain of application. This definition differs from that of "axioms" in generative grammar and formal logic. In those disciplines, axioms include only statements asserted as a priori knowledge. As used here, "axioms" also include the theory derived from axiomatic statements.

Events- The changing of attributes or relations.

Background

Table 1 summarizes the ontology-based approaches that have been done.

Table 1. Ontology-based approaches

Year	Researcher	Approach	Comments
2005	Allemang, D., Hodgson, R. and Polikoff, I., Federal Enterprise Architecture reference model ontologies: FEARMO version 1, 1	Allemang and et al provide FEARMO model to a common semantic understanding.	This model is no more than describe the framework for enterprise architecture FEAF with Web Ontology Language (OWL) and used only for feaf framework.
2008	Fuchs-Kittowski , F. and Faust, D., "*The Semantic Architecture Tool (SemAT) for Collaborative Enterprise Architecture Development",* Springer-Verlag Berlin Heidelberg, vol.5411/2008,pp. 151-163	Fuchs and Kittowski and fast have suggested a architectural tool for cooperation in the management and development conceptual architecture.	To support the people who are involved in the process architecture Collaborative environment is designed like wiki So people and groups who are different and have different spaces record information.
2010	Kang, D., Lee, J. and Choi, S., *An ontology-based Enterprise Architecture.*, Expert Systems with Applications, Vol. , pp.1456-1466	Kang and et al, presented three-level solution architecture based on ontology to solve The lack of a common semantic understanding between different systems and between humans and systems As well as between the various stakeholders in an organization	In the first level business terms, in the second level architectural elements and third level relationship of the elements considered. Emphasis on the use of SBRV approach in enterprise architecture ontologies.
2010	Ghani, I., Lee, C. Y., Juhn S. H., "*Semantics-oriented approach for information interoperability and governance: towards user-centric enterprise architecture management"*, Zhejiang University-SCIENCE C (Computers & Electronics), Vol. , No , pp.227-240	Ghani and et al have proposed a user-oriented management architecture concept.	Pay attention to users as architecture Audience. Trying to provide meaningful information for enterprise users that their function is in line with the needs and scope of them.

All of the research is trying to use ontology in architecture, but none of them did not provide a fundamental solution for architecture and didn't pay attention to the enterprise Ontology as infrastructure architecture. Also, the process for developing architecture based on ontology is not provided. Zachman framework is a kind of enterprise architecture models are considered Mendeleev table, frame of reference that six of data, processes, places, people, events and objectives under the covers. One of the challenges facing the ZF, the lack of a uniform notation language to cover all aspects and its perspectives. The necessity of such a symbol is that modeling is required between vision and framework as well as ways to communicate and the other using a variety of symbols and language modeling to cover the cells causes confusion and disharmony and makes the architects work difficult and complicated. Following we have mentioned the model used in the development of enterprise architecture based on ontology.

The proposed model of Enterprise ontology

TOVE (Toronto Virtual Enterprise) Project is one of the leading projects in the field of Enterprise ontology creation and has produced A subset of names [23] Organization, Resource [24], Activity [25]. For example, the basic concepts underlying the Organization in some columns distributed Zachman. Activity and Resource subsets, respectively, put in the "how" and "who" column. But some columns such as (what) and (Where) is missing. (Table 2)

Table 2. Examine the versatility TOVE concepts with ZF

Why	When	Who	Where	How	What
Organization goal Sub goal Organization ontology	Time(sub ontology)	Organization Division Subdivision Team Organization agent Role Skill Authority Resource (sub ontology)	---------	Activity Constraint Resource Communication link Activity(sub ontology)	---------

The second project is The Enterprise Ontology [26]. Business organizations gathered in this project is a series of reforms. The main concepts in the proposed project is divided into 5 sections which are: activities, organization and strategy, marketing and time. For example, concepts related to the activities in the field of "how" and "who" Zachman scattered but for the aspect of "Where" concept cannot be found. So concepts don't cover all aspects of ZF. (Table 3)

Table 3. Examine the versatility The Enterprise Ontology concepts with ZF

Why	When	Who	Where	How	What
Purpose Critical Success Factor Objective Vision Mission Goal Decision Strategy	Time point Time Interval T-Begin T-End Time Line Calendar Date Duration	Person Organization Unit Actor Machine Skill Capability Authority Resource	----------	Activity Specification Execute Plan Process Specification	Entity Role Relationship Attribute

In the Context-Based Enterprise Ontology [27], ontology organization is considered as background. The main objective of the organization is to provide uniform visibility and Total fields. And also considered general concepts for each of the areas. The proposed concept is divided in 7 areas. The target area includes all the concepts that purpose, motivation, intent on anyone and anything refers. Actors include concepts that the human domain, groups, organizational positions and sectors refers active in the field. Field of operation include concepts that the work done in the field or events that refers. Domain object, refers to the operation of information objects and objects of material that it is used. Field of facilities, including all concepts which by its assets, refers to something done. The local Field, including concepts that are part of the space occupied by some people or some things, refers. Field of time, including concepts that refer to aspects of its time in the field. As can be seen in Table 4 Zachman columns overlap with the areas of corporate ontology. Another advantage of this ontology focus on the production field to the activities of the organization.

Table 4. Examine the versatility Context-Based Enterprise Ontology concepts with ZF

Why	When	Who	Where	How	What
aim domain concepts	Time domain concepts	Actor domain concepts	Concepts location Field	Domain concepts Activities and facilities	Concepts of object Field

Another study in the field of ontology mapping service-oriented architecture with the goal of full coverage to ZF [28] the idea is that the relationship between shared services and service-oriented architecture management requirements defined in the sixth aspect creates. In this study suggest classes that follow from ZF. Including the general meaning has_a, is_a, implements, locations, involves, activities and associative. Original Perspective ontology shown in Figure 1.

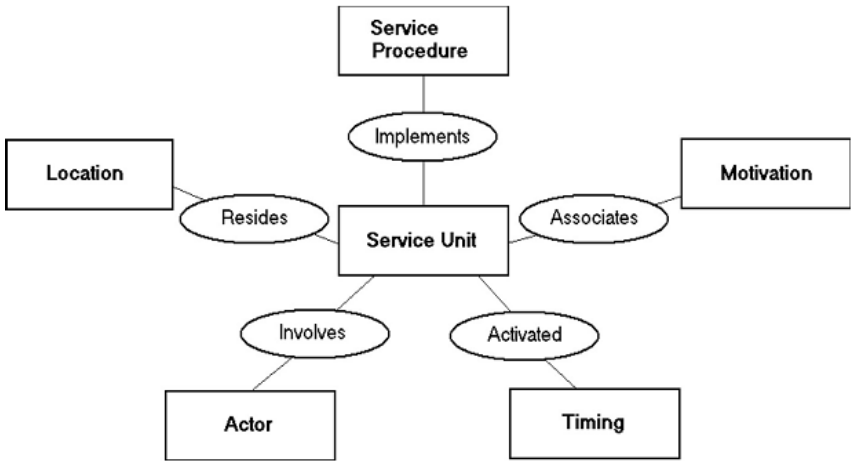

Fig1.Primary ontological view of SOA for SSM

This paper proposes an ontological map of SOA for SSM. The Zachman information architecture framework is the foundation of the proposed ontological map. In the history of SOA, modeling SOA has been dominated by software-centered views. On the other hand, the fast growth SS demands the upper-level business-application-centered views. The proposed ontological map provides an instrument to link SOA and SSM. The contribution of this study is the use of the ontology concepts to actualize the six information architecture aspects in the SSM context. In the proposed map, the components of each information architecture aspect are semantically linked into a unified ontology for SSM.

Another model in [29] presented the enterprise ontology at the conceptual level that used UML diagram. In this model concepts show as class and the association and aggregation relationships between classes is used to show relationships between concepts of ontology. (Fig 2).

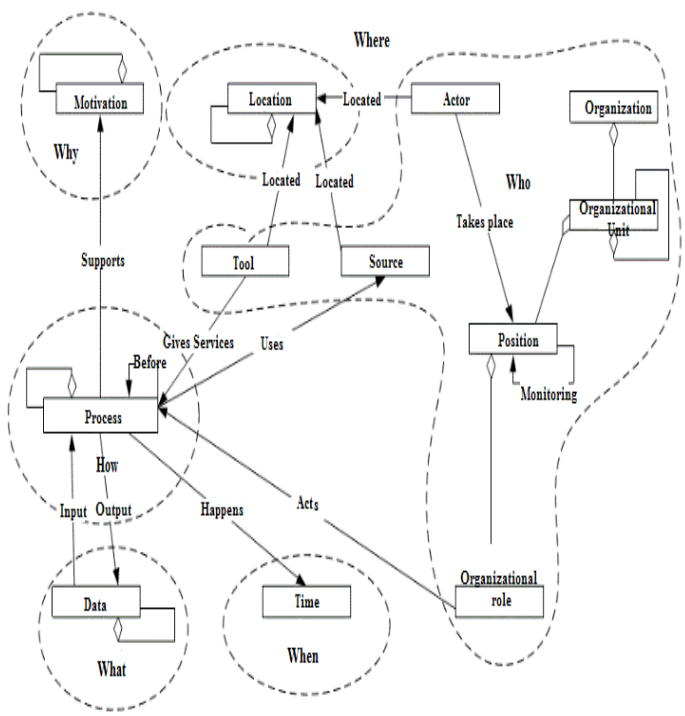

Figure 2. Enterprise ontology model concept-level and its compliance with ZF [29]

Research gap

The proposed model presented in [29] is an infrastructure that used in data collection architecture. The proposed concepts so that is intended to be covered aspects of ZF. The versatility of the proposed model of ZF indicates that this model covers all aspects of the organization. But this model is not complete and only show ontology concepts and relationships at the conceptual level. And did not provide a model for other levels. In this article we have tried to accept the proposed model at the conceptual level (second row) and provide a model for other levels. Note that the first level (Planner) is not a model but a list of things that can be described in natural language. The fifth level (contractor) out-of-themed architecture and its product are not model In addition sixth row (the organization is working) is not view But the actual establishment of the components of the organization. So we are not in the proposed model and is outside the scope of the issue. By accepting the present model on the second level in the next section, we propose a model based on linguistic ontology mapping for third level (designer) and forth level (Producer) of zachman framework.

Ontological map of Zachman framework

One of the applications of ontology is describing the components, concepts and structure of the organization and business. The use of ontologies in the organization, has created a concept called enterprise ontology. Enterprise Ontology is collection of words and definitions related businesses and organizations [30] and usually presented in the form of a classification of areas and concepts scope. Ontology components contains classes, instances, properties, relationships, events, functions, constraints, rules and axioms. Ontological model to cover aspects of ZF components in following will be explained. Since the purpose of the research is providing the ontological model for shared services based on the Zachman Framework. So to achieve the desired model, Zachman Framework is the base model and diagrams used in the basic Zachman are equivalent with ontology tools and components. In Zachman class and components diagrams were used for data column. We must consider that in the ontology which components do something similar with the diagrams. Since the class is the object-oriented framework for classifying objects there is also the class concept in ontology that categories concepts and entities. So class is used for the categories of entities with common characteristics. In the process column used state diagrams, activity diagrams, sequence diagrams and use-case diagrams to show how implementation processing of activities over time, changing the mode of an object and the interaction between the user and the system. There is also the concept of ontology that describes the relationship between class members and instances that is called relation. Relation described any links and interactive semantic relation between the classes and attributes. Location column contains the geographical distribution of valuable resources for organizations and actor column also includes all those involved and interested in the organization which is used to classify each of the classes. In the Zachman used timing diagrams to described Time column. To display time in the ontology also use the events. Because it indicates the changing scenarios of events and relationships and attributes At the point of time also is a good choice for covering columns are at ZF. There is no definition for motivations Column in the Zachman. In ontology concept of axioms also included rules that form a theory which ontology describes a domain application. So to describe the goals and motivations column this is a good choice. Table 4-1 shows conversion object-oriented diagrams to the ontology components and tools. After equivalent object-oriented tools to ontology components, model to cover aspects of ZF for each column is explained below.

Table 5. Mapping UML diagrams to ontology component

Object-oriented diagram	Ontology component	Object-oriented diagram	Ontology component
The class diagram (template for data structure)	Classes (Sets, collections, concepts, classes in programming, types of objects, or kinds of things)	Relations between classes (Associative, aggregation, combination)	relation (display associative relationships between the concept, classes and instances)
Objects (a member of the class has been defined states and behavior)	Samples or individuals (representing elements or people are in an ontology)	Sequence diagrams (showing the exchange of objects in chronological order) And timing diagram (representing events and time distances between them)	Events (changes in relation or attributes)
Attributes (describes a class status)	Attributes (aspects, capabilities, features or parameters that objects or classes can have)	_____	Axioms, laws and general rules

Comparing model with ZF

-Data

Data is important in the organization and service-oriented architecture and used in the operating cycle. So organizations is useless if there is no data and services to provide there. Instances are the main components of ontology and a member of the class and can include objects, people, tables, animals, plants, molecules, automobiles and etc. Classes are also groups of entities or objects that have similar characteristics. The classes can be used to describe the "data" used in architecture. And the relationships between data are described by relations between classes. Classes can be hierarchically classified into subclasses with inheritance. So for the display of data in ontology and in answer to the question "what?" Can use classes and instances.

Process

In ontology, relations show kind of associative relationships between the concepts of domain and include classes and examples of ways which they can communicate with each other. Specifications are entities that can exist without specific classes. Relations are connecting class instances to each other. So the proposed method to illustrate how the processes and service process work and in answer to the question "how?" we use relations and attributes in ontology.

Location

Locations refers concepts that are part of the space occupied by some people or some things. Resources and assets of organization are related to this aspect of the ZF. From the ontology perspective to describe the column locations (network) can be used classes that accommodate resource themselves. As well as instances of classes that include organization assets and stock.

Time

Aspect of time is included in ZF to answer the question "When?" .Changes occur at the point of time. In ontology to show changes in relationships or attributes used events. Events show switching to another mode by using specific circumstances. So the concept of the event can be used to display time column.

People

Those involved in the activities of the organization and includes concepts that refers humans, groups, organizational positions and sectors active in the field. To cover this column we used classes with actor or worker stereotype and instances that are part of the class. In addition use operations part of class, to show the relationship and interaction between people.

Motivation

This column includes, goals, vision, mission, parameters, constraints, success factors and strategies of the organization. To cover this aspect of ZF can be use functions, Constraints (officially Explanations expressed to determine what must be valid until a decision is accepted as input), Rules (sentences that express if - then, inference) and axiom (including rules) in ontology. Table 6 shows ontology model for covering the third and fourth rows of ZF.

Table 6- ontological model for the cover of ZF

Why	When	Who	Where	How	What
Functions Rules Constraints Axiom	Class (with actor and worker stereo-type) Instance	Event	Class (with client and server ste-reotype) Instance	Relations Attri-butes	Class (with entity stereotype) Instance

Conclusion

In this paper we have tried to provide a different mapping than previous methods such as object-oriented and Model driven architecture approach, by combining with service-oriented and ontology to recognize Enterprise ontology position beyond its concept. This is achieved by implementing and adapting ontology vision with Enterprise Architecture Framework. Another purpose is providing the semantic mapping between all aspects and based on this, the proposed model covers all aspects. Considering that service management contains a set of Specific organizational capabilities for providing value to customers in the form of service. The proposed ontology mapping enables managers to think organized in a systematic and reference framework form in the field of enterprise architecture and make decision based on the model that covers all aspects of service requirements.

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From Word Embedding to Inferring user latent Interests

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Abstract

Abstract: Social media websites captured web space. The members of these media are increasing daily. With the data shared by people, researchers try to use them in a proper way to help recommender systems. One of the hot research areas is user interest detection. Intelligent web systems try to extract user primitive interest from contents which are shared by users. While most of the works concentrate on extracting user initial interest, fewer attempts dedicated to understanding latent ones. In this paper, we demonstrate how word embedding methods could help us to enrich user interest's profile. We generate state-of-art user interest modeling which deploys word2vec method for enriching user initial interests that extracted from user's twitter account. Our experimental results demonstrate that using semantic similarity measures, especially when using Word embedding methods, outperform traditional methods.

Empirical results show that enriching user interest profile leads to better personalized content based recommendation.

Keywords:

Latent interest, twitter, word embedding, Word2Vec, User interest detection

Introduction

Nowadays social medias such as twitter become default channel for people communication [1]. Users share and publish posts in many fields such as News, Events, hobbies and etc. Recently researchers try to extract topics and user interest from their shared content for further personalize recommendation. For example in the fourth quarter of 2016, Clinton and Trump candidate for United States presidential debates [2]. So by analyzing tweets from twitter we understand that keywords like "Donald Trump", "Hillary Clinton" and "presidential election" form most of the users topic of interests.

With growing contents of social medias, and by analyzing them, recommendation systems present precise and better recommendation to users. Social media Content personalization gaining more and more attention from companies. Companies try to sell products or services via social channels by advertising [3] or C2C [4]. Content personalization in social medias needs extracting user preference and activity. The contents vary from one social medias to another. Twitter[1] is a microblogging service which shared contents are in text format. Twitter allows users to share post under 140 characters [5]. Identifying accurate information from these micro posts opens new challenge in information extraction. Due to the length of tweets, noisy and informal environment,

1 https://www.twitter.com/

information extracting tasks cannot perform accurately. Therefore enriching tweets to understand semantic of a context proposed recently. Some work using external links such as news website contents to enriching tweets while other use knowledge sources such as DBpedia[2] or Wikipedia[3].

As mentioned Most works dedicated to extracting user initial interests while there is less work done in inferring user latent interests. The ability to inferring latent user topic of interests helps recommender systems to overcome the cold-start problem because the more enriched user interest profile leads to better recommendation decisions. For example, consider tweet by user john:

"Cristiano Ronaldo's brilliant speech in dressing room after winning the Euro Cup with Portugal. #EURO2016"

"Cristiano Ronaldo's Private Jet Crashes While Landing At Airport in Barcelona"

By extracting keywords from tweets shared by john, the topics "Cristiano Ronaldo", "Portugal National Football Team" and "Euro Cup" could be john's initial interests. While these keywords can consider as explicit interest there are some hidden concepts that can infer from them. For example "FC Real Madrid" could be john's hidden interest which considers as latent interests. In this paper, we introduce a model technique to use user information to construct user interest profile. Our model tries to map user tweet to Wikipedia concepts. Till now Wikipedia is the world's largest knowledge resource, which contains more than four million English articles. Each article in Wikipedia created by one or more Editors from all over the world. Each wiki article contains unique topic which can belong to multi categories. Besides Wikipedia's article have content which helps us to disambiguate user mentioned topic from tweets. In this paper, our main goal is to infer user latent interests from initial interests which are mentioned in tweets by the user. To overcome this problem we deploy a novel approach based on word embedding technique which turns user interest into word vector representation space.

The contribution of this paper is threefold. First, we create initial user interest profile by extracting concept from given tweets, using Wikipedia articles. Second, we propose vector-based word techniques to infer the latent user interest from initial interests profile. Finally, we have done heavy experiments to determine the impact of word embedding methods in enriching user interests profile which can further optimize recommendation engines.

In the following section, we summarize related work before we introduce our proposed model. In part 3 we outline the architecture of our model, in section 4 we evaluate proposed approach. Finally in section 5, we conclude our paper and discussed our plans for future work.

Literature review

With the growing impact of the Social Web, or Web 2.0, on our everyday life, people start to use more and more different web based services like Facebook, Twitter, Flickr or blogs. They use these services to express their opinion, communicate with others and share pictures with friends. Thereby, they generate and distribute personal and social information like interests, social contacts, preferences and personal goals [14].

Twitter is an online social networking service that enables users to send and read short 140-character messages called "tweets". Registered users can read and post tweets, but those who are unregistered can only read them. Users access Twitter through the website interface, SMS or mobile device app.

As mention before, Twitter is one of the famous Content-Centric social network, which enables users to send and read short 140-character messages called "tweets". Due to the extensive usage of twitter, a large volume of text is being generated on a daily activity of users. Such a huge volume of user generated data had to be processed to utilize them effectively.

These data could be used in a variety of applications to enhance human life. For processing such huge amount of textual data, more advanced algorithms are required to learn the hidden patterns in the data. Text analytics is the method to process this huge corpus of unstructured text to get high quality data [16].

Text Analytics is defined in Wikipedia as follows:

“Text Analytics describes a set of linguistic,

2 http://wiki.dbpedia.org/

3 https://www.wikipedia.org/

statistical, and machine learning techniques that model and structure the information content of textual sources for business intelligence, exploratory data analysis, research, or investigation."

A text analytics framework consists of three stages: Text preprocessing, Text representation and Knowledge discovery.

In text preprocessing, textual data that are produced by social media sites could not be analyzed directly because these are raw input texts. Preprocessing makes the text more consistent to facilitate the text representation.[16] For instance removing non-English words, transform all words to lower case, removing links and etc.

After preprocessing the input text, only significant words are present in the text. These words need to be represented as numeric vectors to make the analyzing easier. Vector space model or term vector model is an algebraic model for representing text documents or any other objects as a vectors of identifiers. There are different methods in text representing such as Bag-Of-Word(BOW), TF-IDF and Paragraph Vector that we used in our approach ,called Doc2vec.

The Word2vec and Doc2vec model and application by Mikolov et al. have attracted a great amount of attention in recent two years. The vector representations of words learned by Word2vec and Doc2vec models have been shown to carry semantic meanings and are useful in various NLP tasks[17]. As mentioned before we used Doc2vec model to represent each tweets.

Paragraph Vector is an unsupervised framework that learns continuous distributed vector representations for pieces of texts. The texts can be of variable-length, ranging from sentences to documents. The name Paragraph Vector is to emphasize the fact that the method can be applied to variable-length pieces of texts, anything from a phrase or sentence to a large document.[18]

In Bag of words approach, the text is divided into words. This process is called as tokenization. The structure of the text is not maintained in this approach. Each word is represented as one single variable with different numeric weights. TF-IDF (Term frequency/Inverse Document frequency) is commonly used as the weighing mechanism. In string of words approach, sequence of the words is maintained. In most applications, Bag of words is used due to its simplicity [16].

Once the textual data are transformed into numeric vectors, machine learning or data mining algorithms could be used to identify hidden patterns in the text. The most common approaches followed are classification and clustering. Clustering fall under the category of unsupervised learning and classification falls under the category of supervised learning. In unsupervised learning, training data are not required. The documents which contain the textual data are segmented into different partitions such that each partition belongs to a single topic. This process is termed as clustering. In supervised learning, training data are required to make a machine learning method to learn a classifier to classify unseen data. Classification is used in various applications like news filtering, document organization and retrieval, opinion mining, email classification and spam filtering [16].

Related work

Recently mining user interests in social medias especially Twitter become a hot topic among researchers in social media analysis field. Each research attempts to provide specific techniques to detect the user's interests more accurately. Modeling User interests can play a significant role in improving the efficiency of recommender systems. Modeling interests from shared data requires information extraction techniques. Due to tweet's short length and noisy environment, it is difficult to recognize and classify interests from them. Yang et al. [6] propose a model of user interest from tweets based on bag of words techniques. They use cosine similarity to obtain similarity between users in order to find common interests. Bag of words technique has several difficulties in our domain. This technique works on the basis of the number of word occurrences in corpus. Whatever length of a text is longer, the accuracy probability is increasing. Due to the short length of tweets, this technique cannot be a good option to use. However, it cannot extract concepts from text. To understand the concepts from the text, we need Name Entity Recognition techniques. Bontcheva et al. [7] introduced the open source pipeline to extract information from microblogs texts. This system combines the well-known natural language processing tools such as Tokenization,

Normalization, POS and NER to extract named entity. This kind of system requires nominal entities dictionary and countless grammatical rules. Constructing dictionary and grammatical rules need lots of time. Also, due to addition of new entities into vocabulary daily, it is impossible to do. Furthermore this system cannot disambiguate entities. That's why a lot of researchers use external resources for detecting the entities and disambiguation task. Ferragina et al. [8] present powerful system that is able to identify on-the-fly meaningful substrings (called "spots") in an unstructured text and link them to a pertinent Wikipedia page in a fast and effective way. Wikipedia and DBpedia are largest encyclopedias in the world. The advantage of this resource is that the data on these systems are grouping, branching and structured as structured data formats. For example, any article on Wikipedia contains features include creation date, subject, summary, groups, etc. that can be used to improve text processing systems. Tao et al. [9] have enriched user Twitter posts by linking them to related news articles from external news sources and then modeled user's interests by extracting the entities mentioned in the enriched messages.

Above techniques attempt to extract user initial interest by analyzing user shared contents like tweets. However another works dedicated to infer latent user interest. Michelson et al. [10] proposed a method to Discovering Users' Topics of Interest on Twitter. The system design name is Twopics and work in 2 main step: first it specify keywords and then using Wikipedia to disambiguate them. It uses Wikipedia's articles to do that. Then a category sub-tree formation build for each topic. At last topic which has the most term frequency can be the interest topic for user. Opposite to Twopics which extracted high level user interests, Kapanipathi et al. [11] have extracted latent interests of the user by mapping her initial interests to the Wikipedia category hierarchy using a spreading activation algorithm. Although this method is able to create a hierarchy of user interests, but this method is not suitable for real-time applications because the querying on Wikipedia will take a lot of time to get the results. To forecast user interest from microblogging Jiantao et al. [12] deploy Latent Dirichlet Allocation method to model topic of each tweet. They using Singular value decomposition method on user-topic matrix to predict additional user topic of interests. In another work, Zarinkalam et al. [13] try to constructing topic-topic graph and using link prediction techniques in order to infer user implicit interest.

Until now many techniques to calculate semantic similarity between phrases and text documents are provided. One of these techniques is word embedding. Word embedding is a set of language models and learning techniques in natural language processing, in which features words and phrases are mapped to the real numbers. This technique create first by Bengio et al. [14] and branched for many NLP task. In the field of natural language processing, Word2vec is a set of models that was introduced in 2013 by Mikolov et al. [15, 16]. This technique consists of two different algorithms, CBOW and SKIP-GRAM, which represent words in continues distributed vector space. While the CBOW technique uses the words around the current word to predict the current word, the skip-gram technique does exactly opposite, such that it uses the current word to predict the words around the current word. Two algorithms are shown in the Fig. 1:

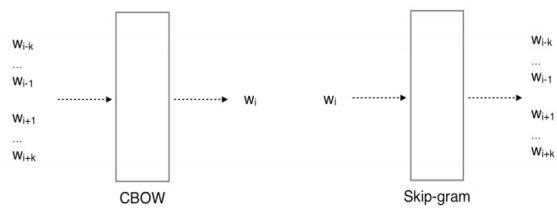


Fig. 1. Word2Vec CBOW and Skip-gram Algorithm Overview

The main contribution of our research in this article are as follows:

- Gathering user tweets via twitter API
- Extracting entities from users tweets
- Modeling user interests into word vector space
- Evaluating our system

In this paper we employed a word2vec's CBOW technique to model Wikipedia articles to enrich user initial interest. In the next section we talk about proposed system framework.

Methods

Overview

Our system framework includes three main stages. In the first stage we create a mechanism for constructing initial user profile interests based on concepts extracted from him/her tweets. In the second phase we are offering a method for modeling initial interests model into a vector space. In the final stage, we use a recommendation algorithm to infer semantic relatedness between user initial interests and Wikipedia word vectors to find best vectors which can further consider as user latent interests.

Wikipedia Word2Vec

In this method, every word in the Wikipedia articles have model using Word2Vec techniques. For each article,$artart$ in Wikipedia corpus $crcr$, each $artart$ preprocessed and all the words changed to lowercase. Then the Word Embedding technique called $Word٢VecWord٢Vec$ have imposed on them. With this processing model, a vector is provided for each word in $artart$:

$$Model = Word٢Vec(cr) \qquad (1)$$

In Which Model includes all vectors of $crcr$ words. Vector generated for the word WW is provided in the following way:

$$v = Model[W] \qquad (2)$$

In this way all Wikipedia articles are considered collectively as a document. This process shown as an example in Fig. 2:

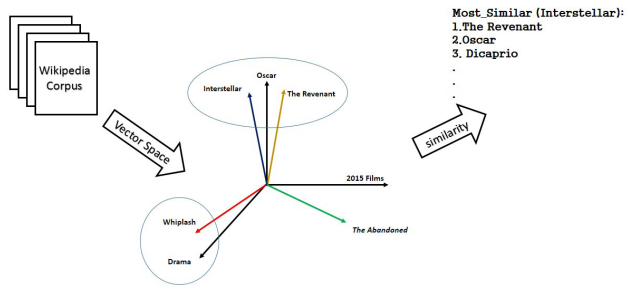


Fig. 2. From Word-Vectors to Recommendation Example based on user interested Movies

User Initial interest filtering

In this paper we create a novel approach to understand effects of enriching user initial interest by deploying word2vec method. After each initial interests extracted, we limited our experiment on Movie domain. We filter initial interests which belongs to Movies related categories. With this, about 1130 movies has been detected. Then all of this movies modeled into Movie Model using Word2vec technique, because only through this we can found the semantic relationship between user interests profiles and a vector version of this movies found.

Recommendation algorithm

Our recommendation pipeline follows the classical workflow carried out by a content-based recommendation framework:

- Initially, each Movie m in a profile of extracted movies from user tweets M, mapping to corresponding Wikipedia article. This is due to enriching movies. We will use summery of Wikipedia articles as movie descriptions.

- With a full movie description, movies model vector made using Word2Vec method ($Movies - Vec$).

- On the other hand, for each item i on user interests profiles I, interest vector constructed ($Interests - Vec$).

- Given both $Movies - Vec$ and $Interests - Vec$, recommendation calculated by the cosine measure.

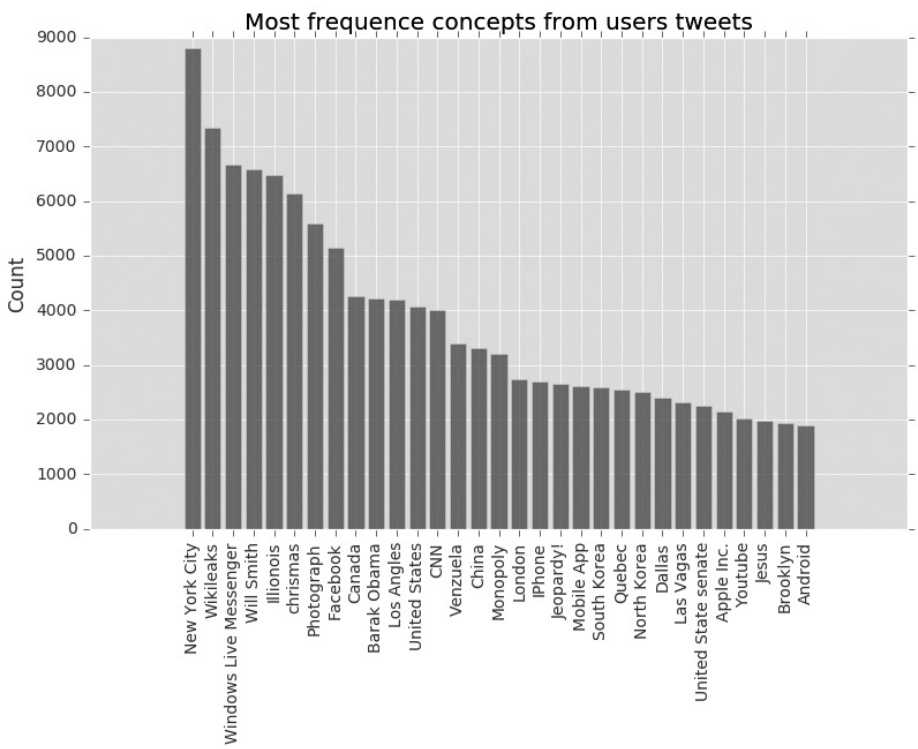
Items are ranked according to their decreasing similarity and $top-K$ recommendations are consider as implicit user interests:

$$Cosine\ Score = \frac{Movies-Vec\ .Interest-Vec}{|Movies-Vec|\ |Interest-Vec|} \quad (3)$$

Experiment

Dataset

Based on our research we choose Twitter microblogging media as a resource for gathering users data. With using twitter API, we crawl specific channels to find users who follow these channels. We filtered 400 user whom are not spam or advertise channel. We also use two other datasets which have academic basics. One data set is used in [17] research in 2011 which can find at here[4] and the other is SIGIR Cross-Social media 2016 [18] which available for public use here[5]. The data filtered from these datasets are shown in below table. In general, 1426 users with about 770 thousands tweets are gathered for evaluate proposed system. This process took about 20 days. We also extracted entities of tweets via TAGME[6] API which took about 10 days. TAGME is a powerful tool that is able to identify on-the-fly meaningful short-phrases (called "spots") in an unstructured text and link them to a pertinent Wikipedia page in a fast and effective way. Fig. 3 shows the Most mentioned concepts which are extracted from all tweets. Fig. 4 shows the distribution of tweets per user's timeline. As we see the number of users with different tweets are very wide.



4 http://www.wis.ewi.tudelft.nl/umap2011/
5 http://cake.da.inf.ethz.ch/OSN-sigir2016/
6 https://tagme.d4science.org/tagme/

Fig. 3. Most frequent concepts of interests

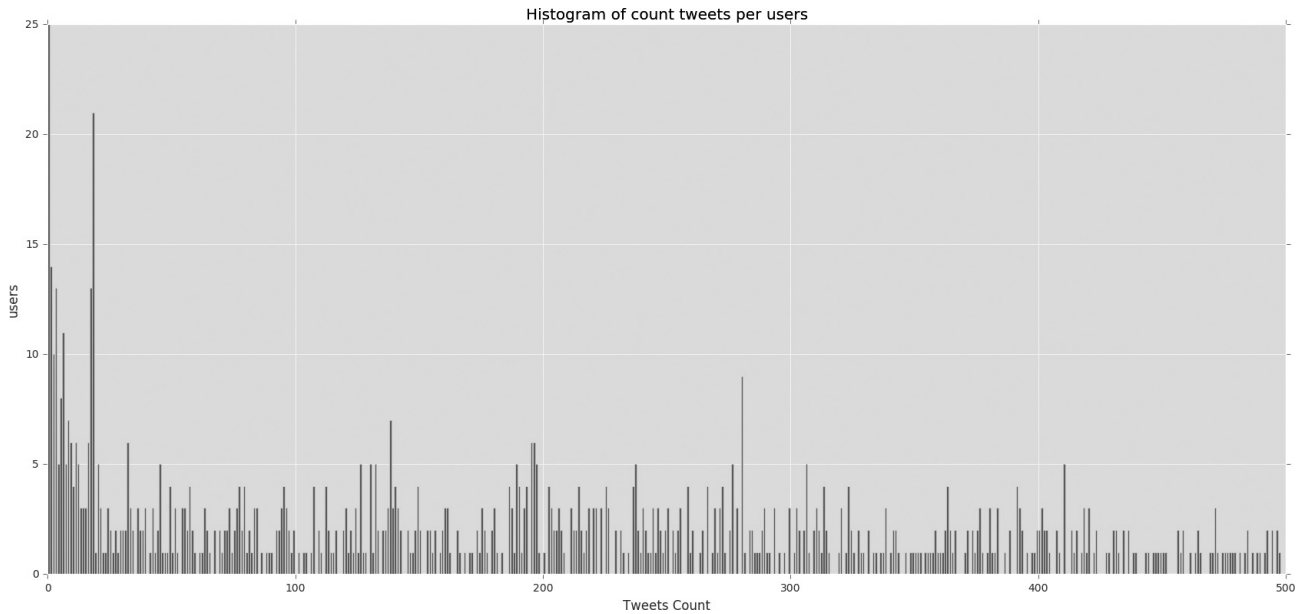


Fig. 4. Distribution of tweets per user

For evaluation purpose we need to create a Gold Standard Dataset from our original one. Firstly, we filtered users who has at least 300 tweets because we want to avoid Cold-Start problem. Also, we extracted all tagged entity which are include in movie category of Wikipedia. The goal of this work is to restrict our test domain for proposed system. So all of the entities which are not exist in movie category are denied.

We creating our Gold standard dataset according to the following criteria:

- All of the user's tweets should be in English
- Each user should have at least 300 tweets.
- Each user interest profile should have at least 5 interests.

Evaluation Methodology and Metrics

Our evaluation strategy is based on leave-one-out method. In this method in each experiment iteration we split our data into training and test set by taking out one of the user interest from his/her Interest tree. After that we predict user interests from remaining interests. If the removed movie is present in the predicted list, we consider this as success. We repeat this process for all items in user Interests profile and extend it to all users. At last average rate for evaluation metrics calculated. For evaluation stage, we computed 3 quality metric which are very famous in recommender systems: Mean Average Precision (MAP-at-k), Mean Reciprocal Rank (MRR-at-k) and Coverage.

For each user, we remove the one movie that exists in user interest profile. We then use the set (of size K) of previously seen movies to predict K movies by proposed recommendation algorithm. If the removed movie is present in this list of K recommended movies we count the prediction as a success, else a failure. The metric is then simply the total percentage of successes over all users. We modeled experiments using Word2Vec to learn item embedding and generating latent user interests to enrich initial interest profile. We use CBOW method with a window size of 5 and Negative Sampling. The dimensionality of the item vectors was set to 400. The experiments were carried out on the about 4M articles from Wikipedia.

In the next section we are shown experiment result for 2 movie model. First model just use user initial interests profile to make recommendation but in second model each initial interests enriched by implicit concepts using our Wikipedia word2vec model.

Results

We calculate our metrics by changing K from 5 to 50. K is the number of recommend items to user at prediction time. In Table 1, we shown the performance of MAP @k and MRR @k for user initial interest model without any enrichment using Wikipedia word2vec model using CBOW algorithm.

Table 1: Results for MAP@k and MRR@K without using Word2Vec model

Metric	**K=5**	**K=10**	**K=15**	**K=20**	**K=25**	**K=30**	**K=35**	**K=40**	**K=45**	**K=50**
MAP	9.96	16.78	22.61	26.95	30.32	33.49	37.15	40.15	43.25	45.59
MRR	28.74	35.90	39.35	41.14	42.22	43.04	43.84	44.41	44.93	45.27
COV	92.43	95.98	99.70	100	100	100	100	100	100	100

As we can see by increasing K, Total success rate increased and this is the fact that the probability of existence item in bigger recommendation list is obvious. Table 2 shows the result of using Wikipedia Word2Vec CBOW algorithm:

Table 2: Results for MAP@k and MRR@K with using Word2Vec model

Metric	K=5	K=10	K=15	K=20	K=25	K=30	K=35	K=40	K=45	K=50
MAP	13.01	20.24	26.17	31.26	35.33	39.22	43.12	46.62	50.24	53.65
MRR	31.93	39.62	43.17	45.31	46.60	47.62	48.48	49.14	49.74	50.25
COV	98.63	100	100	100	100	100	100	100	100	100

As we see, by using enrichment on user initial interests and adding it to user profile as latent interest, prediction accuracy raise by **5.7** percent. Also Reciprocal Rank increased about **4.3** percent. We infer that initial interests enrichment can help us to extend semantic similarity between user topic of interests which help recommender systems to identify and predict better items to propose to user. Fig. 5 and Fig. 6 demonstrate Table 1 and Table 2 in graphical format. It is clear that enriching user initial interests using Word2vec model outperforms baseline system.

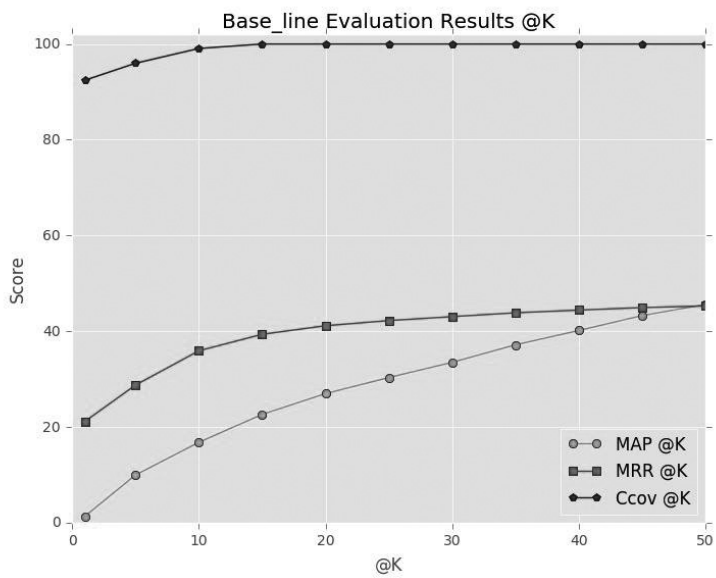


Fig. 5. Diagram results of proposed system without using Word2Vec technique

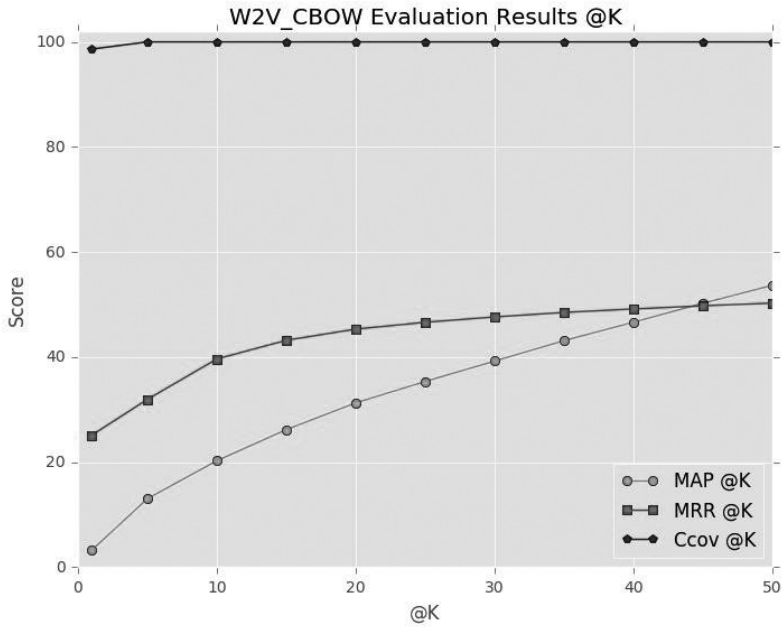


Fig. 6. Diagram results of proposed system without using Word2Vec technique

Based on our assumption, the low value of MAP and MRR for primitive K values suggests that the semantic relationship between user interests are too low. This is natural because concepts which users mentioned in their tweets vary in type and counts. For example user maybe talk about 20 movie which are vary in genre. Our goal is to enrich movies to increase the semantic relationship between the movies for better prediction. This is an interesting observation that insinuates, users often are interested in topics that are around similar topics. As we see in fig 7, there is no direct way to capture similarity between movies which user has seen but with enriching them we can create a semantic path between topics.

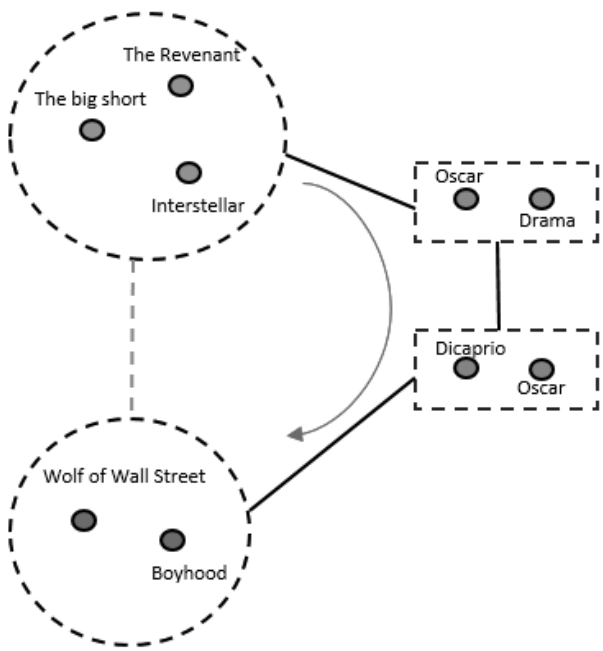


Fig. 7. Users Topics Interests Enrichment for better Semantic Inferring

Conclusion

In this paper, we studied the influence of enriching user initial interests profile with word embedding methods. By deploying state-of-art NLP techniques into user interest modeling, several improvements observed. By utilizing proposed approach to model twitter user interest, generated item recommendations shows very good result. In the future, we try to experiments other semantic similarity techniques to compare results based on social medias content.

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Grievance procedures in the Cross Country Organizations: A powerful key to Employee Retention

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Abstract

When employees feel injustice in the organization then he/she expresses it in different ways: verbally, non-verbally, formally, non-formally, etc. Grievance handling is a process of hearing employees complain for increasing employee productivity. This research investigates what grievance handling procedures are followed in the organizations, do traits of the HR manager's contributes to its success, do mangers perceive the grievance in the same ways as employees perceives and what specific traits of managers are more contributory. The method adopted in the research is qualitative and quantitative. The instruments are questionnaire and interview. The sample of the organization constitutes 50 organizations of Nepal of different nature. Sources of information are primary as well as secondary. Preliminary findings support that trustworthiness in the managers are most significant factor for effectively handling grievances.

Key words: grievance, grievance handling procedures, employees, managers, etc.

Introduction

Grievance has been defined by Word Web Dictionary as " An allegation that something imposes an illegal obligation or denies some legal right or causes injustice" and "A complaint about a (real or imaginary) wrong that causes resentment and is grounds for action" An organization constitutes of divisions of different functions to different people so as to complete definite objectives. The functions are carried out with the help of different resources, and different roles of the people. Unlike machine and tools, human beings who perform the jobs have feelings, perceptions, and beliefs from which they form attitudes. These affect the functions quantitatively and qualitatively that the person is doing. For each of these functions there is a reason to which we call stimulus that excites individuals or make feel to claim. Grievance is a claim that an individual group presents to his office to draw attention of the manager or supervisor the he/she needs address. Generally grievances are raised from the provisions stated in employee contact and labor legislation. For an instance, grievance relates to working conditions, pay and benefits, leave and facilities, and working hours.

People's feeling towards the behavior of the working place has two sides, pleasant side and unpleasant side. Unpleasant side should be ventilated giving him/her opportunity to express with the supervisors with a hope to be addressed such unpleasant matters through some remedies. This process is called grievance and how this action is processed is called is grievance handling process in the organization. The main reason behind sound grievance procedure is to accommodate every individual in the main stream of organizational functions. Unsatisfied people might be involved in any short of damages in the organizations that can be simply reducing works to damaging physical and human property of the organizations. The main source of grievance is feeling of injustice from the supervisor's behaviors, system, pay, roles, and facilities.

In the organization when people behave with others he/she is judging the behavior of the counter parts from his/her eyes. Every time the behavior of any organizational people is compared with each other, and some behaviors are subject to be unpleasant, immoral, contrary to law for some individuals, then it comes under grievance. Grievance is related to claims from the subordinates to upper level or same. To the subordinates it would be disciplinary action. The feeling of superiority or inferiority in behavior give birth the grievance. The behavior of organizational people is expressed in the form of claims, payment of work to the employee, respect and regard extended, roles given, responsibilities assigned, and controlling imposed, etc.

Objective

Objective of this study is to explore what procedure of grievance handling Nepalese organization have been adopting and what procedure are being followed in other countries.

Research question

The research questions developed in the study are:

How far organizations in Nepal are serious towards grievance handling procedure? What procedures they apply? Have they developed any policy regarding grievance handling?

Statement of the problem

Employees must be the prime concern parties if organization is to run efficiently. It is the employees whose qualitative and quantitative performance engenders organizational performance. Mostly the motivated and considered employees do organization's job seriously. For getting employees fullest potential only the skill and knowledge in the employees are not sufficient. They must feel secured in the sense that their talents and skills are recognized in the organizations. Organizations reward them without discrimination and if any organization has mechanism to hear them and take any remedial actions immediately.

In present situation, the society is turned into a society where people become busy for their own sake. This is found mostly in the urban and sub urban areas. Most of the organizations reside in such areas where people have no time to see others and understand others. An organization is also a mini society where people have their own business. But organizations people might have problems to be addressed. In such a situation if they are not heard and addressed their regular work might be affected either mentally or physically. Physically means they may need instruments, physical space, supporting people, machine, etc. to complete the task successfully. And mentally means they might not be secured due to discrimination in works, regards, and relations. Employee productivity can be affected by such unattended behaviors to the works by the employer's or managers. This type study helps the organizations by exploring such practices and aware the managers to stop so employees will not be frustrated by the feeling of not being responded by the managers of the organizations.

If mechanisms for grievances are not studied then people who are working in the organizations cannot be known how much they are satisfied in the organizations and anticipated how much they will work for the organizations. It is that fact that merely employing the people in the organization, their fullest potentialities cannot be obtained unless organization understands them what they need, and where they are unsatisfied. If what shorts of procedures could be better and what shorts of grievances employees in the present organizations have is fully known, then managers of the organization can be aware of the possible situation and can be prepared him for the future. Right management is always a proactive measure. It is essential that a stitch in time saves nine.

Employees retention and employees engagement are essential job of managers. These two things are badly affected if grievance procedures are weak in the organization. In order to know whether they are weak or not research in this field has been essential. Individual differences are apparent on the organization, no two person's interest is alike, so it has been essential to develop a system that can be used to handle the grievances to address all the people of differing interest and differing situation. Certainly this is challenging job which requires rigorous study and investigation. Level of expectations differs from people to people and most of the grievances arise due to the rise of expectations of the people. Even the expectations of two people differ; in the same person also it differs from year to year so knowing this and developing of model of grievances have become very tough job requiring vigorous study.

Review of literature

Grievance is any discontent or dissatisfaction arise in the employees, whether expressed or not and whether valid or not, when an employee thinks, believes, or even feels is unfair, unjust or inequitable [10]. According to ILO as cited by Singh [11], a grievance is an expression of discontent towards managerial practices related to wages, allowances, working conditions, overtime, leave, transfer, promotion, seniority, job assignment and security of service.

Difference literature of management has suggested differing methods of grievance procedures and approaches: proactive approach, and reactive approach. One such proactive approach can be equity theory, which states that equal pay should be provided to equal performance (Adams (1965), as cited in [1]). People compare the rewards what the get with the rewards what others get for similar jobs [2].

Reactive model holds the value of grievance when conflicts arise in the organization. Conflicts arise in the organization as a result 8 factors, Change, Interpersonal Relationships, and Supervisor vs. Employee, External Changes, Poor Communication, Subpar Performance, Harassment, Limited Resources [3]. Conflict in the organization can be interpersonal, and inter group; interpersonal refers to two people like, supervisors and employee, and inter group refers to two groups like, managers and workers, two trade unions, and two departments[4].

If an employee is allowed to choose whether a particular issue raised or not, is called grievance capturing system. This gives opportunities to employers or managers to know the information and diagnose the situation and take actions like to reject at the initial stage, or consider some parts of it or accepts fully [5]. If grievances are handled properly at its initial stage in this way, then it increases productivity.

Another method of grievance handling is grievance handling procedure through collective bargaining. Under this union put their demands, and management hears the demand so this practice is better to maintain relation with different parties [6] involved in the organization.

For the effective grievance handling system a recent research carried out by Gomathi suggested to organize education and training on employee morale, to initiate discussion on the Vision and Mission statements of the company and the ways to achieve, to orient more clarity on roles and responsibilities to be carried out by individuals (Duties and rights), develop a system of suggestion box to facilitate the employees to give their suggestion to improve the organization and the performance of the employees as well, to solve the problems considering their importance, urgency and implications, to organize informal counseling helps to address and manage grievances in the workplace, to develop clear job descriptions, and a preview of everyone expected behavior from each individual towards goals and expectation including what is expected from each individual. [7].

A review on the grievance policy issued by University of Edinburg reflects some steps and procedures of grievance [9].

Informal procedure: aggrieved employee will ask for a time to have meeting to complain informally for the injustice felt. Both the parties: aggrieved employees and managers sit together for the settlement of the grievance. There can be more than one meeting of employees and managers. When informal procedures fail, then formal procedures might be felt essentials with some additional steps as listed down. The role informal procedure is very high in the organization. It reduces the chances of destruction and negative impacts of injustice felt by employees timely because at the initial stage manager or supervisor can get opportunity to understand the injustice felt

by employees. Informal process also saves the parties involved from lengthy processes of grievance handling that can cause tension to aggrieved employees and respondents and witness too.

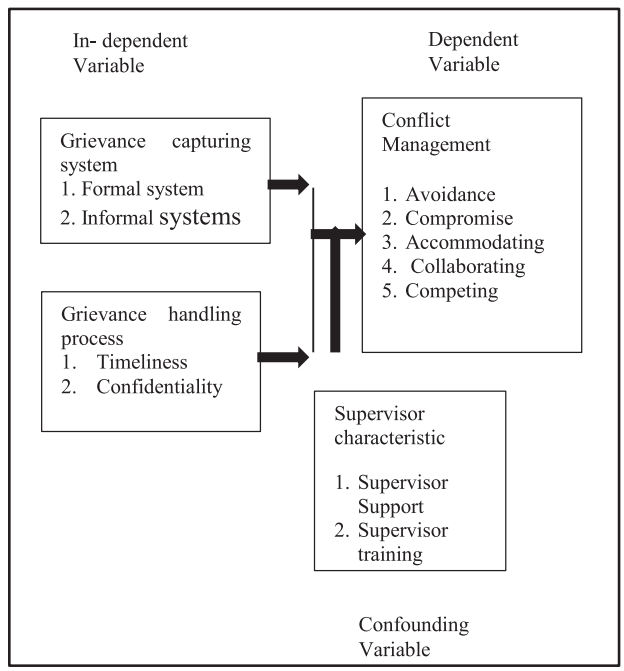
A. Formal process: A formal process is the process stated by labor legislation. Generally the process follows the following steps.

Table 1: Steps of formal grievance

Steps	Functions
1. Appointing an Investigating Officer	Grievance hearing chair will appoint an investigation officer
2. The investigation	Investigation will start with the discussion with complainant. All the information received during investigation must be kept secret.
3. The Right to be Accompanied	The employee (complainant or respondent has right to be accompanied by other employees for witness.
4. Confirming the Outcome of an Investigation	Outcome of the investigation must be given to the manager who appointed them. A copy of such outcome will be given to complainant.
5. Appeals	If the complainant feels that his/her grievance is not resolved satisfactorily, then he/she may appeal stating the ground of the appeal.
6. Grounds of Appeal	Generally ground of appeal can be evidences are not considered and procedures are not followed.
7. Appointment of an Appeal Convener	When appeal is received the manager appoints convener who will be experienced, qualified, and
8. Hearing the Appeal	After hearing the appeal there will be one of the two responses: appeal upheld and appeal not upheld.
9. Timescales	A time is to be fixed for responding the appeal.
10. Vexatious Grievances	complainant may be subject to disciplinary action if found vexatious or malicious

A conceptual framework discussed by Njiraini [8] is presented here. The framework (The Figure 2) defines what determines effective grievance handling procedures. It also establishes the relation between grievance handling systems, grievance procedures. This model also how conflicts are effectively managed through timeliness in grievance procedures and confidentiality in the handling procedures. Similarly it can be investigated from two ways: formal system and informal system.

Figure 2. Conceptual framework of grievance handing



When grievances arise its handling steps vary from organization to organization, based on size and other factors of the organization. Mamoria has mentioned five or six steps for medium and large organizations, with minor variations [12].

The Figure 2 displays how employees' grievance originates and where it is settled in the organization. According to this figure it starts from the organization's weak managerial practices of handling people without considering socio psychological climate. It is settled when organization improves it in making climate where people happily live, think, interacts and feels ownership. Making reflections from theses literature a five step model is presented.

Figure 2: A typical diagram showing grievance handling process

Method

The method adopted in this study is quantitative as well as qualitative. A set of questionnaire has been designed to explore the grievance handling practices of Nepalese organizations. Likewise, secondary data also was acquired from different journals and magazines. For the collection of information from Nepal, 50 officers from 50 organizations were enquired through questionnaire. The grievance handling procedures of some other advanced countries were collected from secondary sources. Existing laws relating to grievance handling mechanism also were reviewed.

Result and discussion

Enterprises sampled

Table 3: Type of ownership and sector

Type of ownership	Sector		Total
	Production	Service	
joint stock	12	13	25
Not for Profit	0	6	6
Partnership	4	10	14
sole trading	1	4	5
Total	17	33	50

Source: HR Survey, 2016, August

Enterprises nature and types

Table 4: Industry and sector

Industry	Sector		Total
	Production	Service	
Agriculture, horticulture, animal husbandry, fishery	0	1	1
Banking, insurance and Financial institutions	0	4	4
Education and Training	0	10	10
Gender and Social Inclusion	0	3	3
Hotels, Travel & Tour	0	6	6
Hydropower	1	0	1
Information communication and technology	1	5	6
Local Road Bridge	0	1	1
Manufacturing and assembling	15	0	15
Trade	0	3	3
Total	17	33	50

Source: HR Survey, 2016, August

Provision of grievance handling under labor relation

In Nepal, A formal process is stated by Labor Act, the Clause 72-75, Section 10, under Settlement of Disputes. The claim is to be presented by the individual or by the union for the settlement.

Table 5. Procedures for making individual claims or collective complain.

Complains from individual employees	**Collective bargaining**
The individual aggrieved must apply stating the reason of complain to general manager.	Trade union can apply by signing 51% or more workers (taking consent of majority).
To such application general manager must settle within 15 days of the application received.	To such application general manager must settle within 21 days of the application received.
If manager cannot give satisfactory answer then aggrieved can apply to labor office. Labor office must mediate complainant and manager within 7 days.	If the union is not satisfied with the action of manager then it can apply to Labor office. Labor of gets 15 days' time to mediate.
If mediation is not possible then chief labor officer gives decisions within 7 days	If mediation is not possible, the matter can go to arbitrator, for which he/she gets 15 days' time.
If the decision is not satisfactory then unsatisfied party can appeal with the labor court within 35 days	If the decision is not satisfactory appeal with the labor court within 35 days

1. Union can give notice of strike with the consent of 60 % secret ballot, if not satisfied by above means

2. The employer can lockout by receiving approval from the government.

Grievance recognition method

Grievance handling method requires two steps: recognition of it and solving. In order to know the grievance recognition method enterprises were asked by giving 4 options. The Table 6 reveals that 36 (72%) stated that they apply open door and 26(52%) stated they apply observation. Some 17(34%) opined exit interview.

Table 6: Employee grievance method adopted by enterprises

	response	%
Through observation	26	52
Open door	36	72
Gripe box	8	16
Exit interview	17	34

Source: HR Need Survey, 2016, August

Grievance handling method

Table 7 reveals that 24(48%) enterprise adopt handling 'individual counseling by line managers'. Eleven (22%) adopt 'personal intervention by CEO' and 10(20%) apply 'formal grievance procedure'. Existing labor laws of Nepal also have prescribed many steps to handle the grievances, however there can be many ways to handle grievance which are short and simple. Maintaining litigation, going to labor department and court for it is very clumsy and frustrating job so effective grievance procedures should be developed making them acceptable to enterprise and employees both.

Table 7: Grievance handling method adopted by enterprises

	Priority in ranking			
Methods	**1st**	**2nd**	**3rd**	**4th**
ersonal intervention by CEO	11	7	4	6
Individual counseling by line managers	24	12	4	1
Through the formal grievance procedure	10	7	6	6
Through involvement of the union	1	5	6	6
Through discussions with the foreman/shop floor supervisor	2	7	10	8
There is no clear system: grievances are handled in an ad hoc manner	3	5	2	7

Source: HR Need Survey, 2016, August

Conclusion

The most frustrating environment for employees is he has no one to hear his complain. In Nepal in most of the public sectors high level employment is influenced by political interest. High level positions are fulfilled by major political parties. This creates middle level and junior level transfers to be the subject of nepotism and favoritism. Mass complain is there for this misguided system, but hearing should be made by upper level political leaders but this is subject to affect them unfavorably, that is why this issue has not received any priority in the country. And leaders are losing political faith from the people because talented people have already been out of the main stream. Government inefficiency level is very high because of political influence on the employment practices and their unresponsive culture.

In the case of private organizations, there is found practices of grievance handling. Generally private organizations were found using individual counseling. Only 10% organizations adopt formal procedures.

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Rewarding Practices in the Organizations of Developed and Developing Countries for Employee Productivity

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Abstract

Motivated people are more productive than non-motivated people. People in the organizations are motivated through rewards, which are intrinsic and extrinsic in nature; monitory and non-monitory and direct and indirect. How rewards are fixed in the organizations, and what factors determine reward of the organization are the major issues this research tries to discuss. The research is based on cross country comparison. The methods adopted are both qualitative and quantitate. Both secondary data and primary data have been used in the research. Sample of the study constitutes 50 organizations of different nature: manufacturing, and service. The preliminary findings resemble that there is significant effect of rewards on performance if such rewards are matched with the employee's needs and aspirations.

Keywords: reward, intrinsic reward, extrinsic reward, individual performance and organizational performance

Introduction

When people work they get something: but the question is what to be paid for it, what to be paid for the work. Anything, people get for the performance in exchange is termed as reward. Such reward can be financial (something of monetary value) or non-financial (something of non-monetary value). Reward has worth if it is linked with performance and performers interest. It can have any form intrinsic or extrinsic. People become satisfied themselves with their own work is the intrinsic reward and they get something from the outside is extrinsic reward. Whatever is the form, reward is motivator because this makes one performer. This changes the people from lazy to active, unsocial to social, less creative to more creative, less useful person to more useful person of the organization. And consequently changes the organization from less responding to more responding, less competitive to high competitive.

The difference between the extrinsic reward and intrinsic reward lies on the level of achievement [1]. Extrinsic reward fulfill basic needs like income to survive, feeling of stability and security in the work place and recognition in the workplace from others. Intrinsic reward refers to feeling of enjoyment one receives from his/her performance. It is the satisfaction that performer receives from his work; it is psychological in nature.

Objective

Main objective of this study is to explore how employees receive rewards and how they are managed in different organizations of Nepal.

Review of literature

It is the scientific management theory that tried to develop methods of production that help to produce goods by reducing costs and motivating employees through financial rewards based on pay for performance, commonly known as piece rate system[2]. This theory broke the concept that cost of production will be higher if employees are highly paid, but it brought the insight that if production method is reduced it will lower the cost of production from one perspective and if employees is paid higher more the employee is motivated to give more production. Taylor wrote shop management to prove that high pay to workers and low labor cost is the foundation of best management. Scientific management theory put stressed in paying immediate pay rather than group pay like profit sharing indicating that average workers do not take interest on what the profit will be after six month but take interest on what he is getting after the work completed.

When Halsey plan developed "The Premium Plan of Paying for Labor", workers received a guaranteed day rate, plus a premium rate based on time saved which was derived from past production records [3, 4]. The differentiated piece rate system came out from Taylor after Halsay plan and made a scheme for high rate was set so that the average employee who met the standard could earn 125 percent of the standard base pay; the low rate was set at 90 percent of the base [5]. Gant developed a plan based on paying the workers for the time allowed, plus a percentage of that time if they completed the job within the standard time or less [4]. Emersion developed a plan to pay for efficiency; under this there is established a bonus system which grouped efficiency ranges and equated a percent bonus for each range [5].

Lillian Gilbreth described the characteristics of good reward system: (1) worker must perceive it as positive gain, (2) predetermined, (3) designed for individual and work, (4) fixed, (5) assure and (6) prompt [6].

Skill based pay is popular these days, it emphasizes on skill, and competency rather than position one holds [7]. Similarly pay based on performance rewards individual or groups based on equal pay for equal performance [8]. Top performers are selected and paid more [9, 10].

The review of reward system reveals that Reward systems should link individual pay with performance, (2) Reward systems should reflect the situation at hand , (3) Reward systems should promote increased productivity and efficiency without sacrificing quality (4) Reward systems do impact labor-management relations (5) Reward systems should be accepted and understood by employees (6) Reward systems should be timely (7) Reward systems should be designed with the notion that money is a motivator.

Hierarchy of needs [15] the oldest theory prescribed by Maslow stated that people perform to fulfill their needs which is hierarchical, when one need is fulfilled another starts. But recent literature has discarded theory to some extent, which means it is applicable to some but not to all.

The review of recent literature on what forms of rewards do you expect or often receive as a result of good performance, conducted by Peter Kawara reveals interesting results about reward and performance [11]. The research enquired 75 employees and analyzed their opinions.

Table 1: Effects of rewards on performance

Reward factors	respondent	%
Salary increment	22	29.3
Recognition and training	34	45.3
Handling greater job responsibilities	6	8
Promotions and Participation in key decision making	13	17.3
Total	75	100

Source: Peter Kawara (2014)

This research seems to include the design of two factor theory [12]. This theory divides job-related factors into hygiene factors and motivators. Hygiene includes working condition, salary and good colleagues without which performance seems impossible for long time. And motivating factors stimulates one to use his/her intrinsic interest and abilities and recognition from others. Actually this theory rise total reward system and both are essential for performance.

Vroom, in 1994; and Bohlander and Snell, in 2004 linked performance with the expectation. If a person feels his/her expectation is being fulfilled, then he/she works hard.[13, 14].

Now a day's total reward system is gaining popularities. The principal elements of total reward are basic salary, variable pay, pension benefits, death-in-service benefits, long-term disability benefits, private medical insurance, vacation entitlement, company car schemes, share schemes, mortgage subsidies etc[16]. The Aon Hewitt [17] defined Total Rewards as everything an employee gets from the employer that they find rewarding (i.e., compensation, benefits, learning, development, etc.)

Figure 1: Total reward framework

<table>
<tr><td></td><td colspan="2">Experiential</td><td></td></tr>
<tr><td rowspan="2">Company</td><td>Environmental
• Leadership and culture
• Physical work environment
• Work life balance</td><td>Developmental
• Career opportunities
• Learning and developments
• Goals and coaching</td><td rowspan="2">Personal</td></tr>
<tr><td>Benefits
• Health and wellness
• Retirements and savings
• Paid time off</td><td>Compensations
• Base salary
• Annual incentives
• Stock/LTI awards</td></tr>
<tr><td></td><td colspan="2">Financial</td><td></td></tr>
</table>

Armstrong simply listed total reward system under two headings transactional reward and relational reward.

Figure 2: The components of total reward

<table>
<tr><td rowspan="3">Transactional reward</td><td>Base pay</td><td rowspan="3">Total remuneration</td><td rowspan="5">Total reward</td></tr>
<tr><td>Contingent pay</td></tr>
<tr><td>Employee benefits</td></tr>
<tr><td rowspan="2">Relational reward</td><td>Learning and developers</td><td rowspan="2">Non-financial intrinsic reward</td></tr>
<tr><td>The work experience</td></tr>
</table>

Source: Armstrong and Brown, 2006

Attraction, Retention, and Engagement Drivers Are Different. [17].

Table 2: reward for attraction, retention and engagement for employees

Attraction	Retention	Engagement
Competitive base pay	Senior leadership making right decisions for the future	Clear career path
Competitive health care benefits	Necessary tools	Involved in decisions that affect my work
Financial stability of company	Competitive health care benefits	Necessary resources
Flexible work schedule	Necessary resources	Career development
Competitive retirement benefits	Reliable workgroup	Teamwork

Source: Total Rewards Survey Transforming Potential Into Value, 2012

Method

The method adopted in this study is quantitative as well as qualitative. A set of questionnaire has been designed to explore the grievance handling practices of Nepalese organizations. Likewise, secondary data also was acquired from different journals and magazines. For the collection of information from Nepal, 50 officers from 50 organizations were enquired through questionnaire. The rewarding procedures to employees of some other advanced countries were collected from secondary sources. Existing laws relating to grievance handling mechanism also were reviewed.

Result and discussion

Enterprises sampled

Table 1: Type of ownership and sector

Type of ownership	Sector		Total
	Production	Service	
joint stock	12	13	25
Not for Profit	0	6	6
Partnership	4	10	14
sole trading	1	4	5
Total	17	33	50

Source: HR Survey, 2016, August

Enterprises nature and types

Table 2: Industry and sector

Industry	Sector		Total
	Production	Service	
1. Agriculture, horticulture, animal husbandry, fishery	0	1	1
2. Banking, insurance and Financial institutions	0	4	4
3. Education and Training	0	10	10
4. Gender and Social Inclusion	0	3	3
5. Hotels, Travel & Tour	0	6	6
6. Hydropower	1	0	1
7. Information communication and technology	1	5	6
8. Local Road Bridge	0	1	1
9. Manufacturing and assembling	15	0	15
Trade	0	3	3
Total	17	33	50

Legal provisions

One month's advance notice and Lump sum compensation at the rate of 30 days' salary for every year of service need to be paid for laying off. 10 % provisions on gross profit for arrangements for quarters, Provision of minimum revision committee. Every workers are subject to Protection of eyes, Protection from chemical substances, Arrangements for protection from fire, Dangerous machinery to be fenced, Lifting and carrying of excessive loads. Welfare fund, Compensation. Bonus, provident fund, and medical benefits, Leave provisions. The minimum wage is applicable to all workers/ employees irrespective of status of the employment or the length of service." (Upreti & Pandey, *supra*.) The tea estate minimum monthly salary for the current fiscal year, from February 1, 2016, through July 15, 2016, is NPR6,375 (about US$60), and the minimum daily wage is NPR228 (about US$2). There is also a daily allowance of NPR30 (about US$0.28) for tea refinery and factory workers and certain other tea estate workers. (*Id*.) For the period after the current fiscal year, from July 16, 2016, through July 15, 2017, the minimum monthly tea-work-related salary will increase to NPR7,075 (about US$67) and the daily wage to NPR253 (about US$2.40); the daily allowance remains the same amount. (*Id*.)

Why employee works because of reward. Reward is something making the employees active so this chapter has significant role in the survey. Reward includes everything that an employee receives for his works and which initiates him/her to do same again and again. It is the reward for which a person does hard labor, displays positive attitudes and sacrifices for the mankind. If an employee does work for business it does not mean for a particular business but the society to fulfill the needs and support the nations for wellbeing. But how much reward and what types of reward is most appropriate for an individual it is the questions of controversy every time. So an enquiry was made with the enterprises. The Table 11.1 gives information about the bases of reward system. Twenty two (44%) stated that their reward is more than what government pays to their staffs. It means they try to maintain equity with the government employees. Eighteen (36%) enterprises state that minimums wages that government has fixed is maintained. It concept is legal binding and providing right to live. Thirty one (62%) percent stated that their rewards are based on performance which means more the performance more the salary. It is motivating and initiating that employee will do more work.

Table 3: Bases of reward system

Feature	Response	%
Meet minimum wages	18	36
Equivalent with government scale	14	28
More than government scales	22	44
Based on performance	31	62
Any other……..	4	8

Source: Field Study, 2016, August

The Table 11.2 discloses that salary fixation is based

on unilateral decisions of management whereas 21 enterprises (42%) have stated that it is based on collective bargaining. The concept of collective bargaining means, hearing the interest of majority of employees. It gives message that the people who work for the organizations should feel proud that they are being treated as important group for the organizations. Mostly in manufacturing enterprises, salary is maintained by this method.

Table 4: Process of fixing reward system

	Response	%
Collective bargaining	21	42
Unilateral decisions by management	26	52
Other methods (Please specify)	3	10

Source: Field Study, 2016, August

Equity on reward system

Every time when salary is increased then employees judge their salary increments with the salary of their superiors and other colleagues. Equity means relation of reward with performance. It bases its principle on more performance carries more reward. Enterprises under studies were enquired whether this feature is addressed in their reward system. Does the organization recognize individual performance or merit in granting wage/salary increases and increments in respect of the different categories of personnel equally? Thirty three (66%) enterprises stated that it was addressed in more extent to upper levels. Twenty nine (58%) enterprises state that it addressed more to skilled level employees and 24(48%) stated that enterprises care for semi-skilled and unskilled too. This has reflected that reward is subject to the skill and knowledge. One of the principle in reward is it must be based on equity.

Table 5: Reward for personal category

Category	Yes	%
Managers/Executives	33	66
Supervisory and clerical personnel	33	66
Manual & operative employees(Skilled)	29	58
Manual & operative employees (Semi-skilled and unskilled)	24	48

Fringe benefits

The Table 11.4 states the major fringe benefits that enterprises are providing. Fringe benefits are designed to meet the essential needs of the employs besides base pay. It helps to increase employee loyalty because it gives feeling in the employee that when enterprise has something it shares with the employees for the welfare of the employees. On the enquiry it was found that 37 (72%) enterprises are providing transport facilities. Twenty nine (58%) are providing uniforms. Thirty four (68%) enterprises are providing annual bonus. Thirty two (64%) enterprises are providing encashment leave. Similarly attendance incentives, production incentives, loans are also some other fringe benefits that organizations are providing.

Table 6: Major fringes benefits

Title	**Response**	**%**
Transport facilities	37	74
Uniforms	29	58
Production incentives	19	38
Attendance incentives	17	34
Annual bonus	34	64
Loan schemes	20	40
Encashment of leave	32	64
Other allowances (Please specify)	8	16

1. Source: Field Study, 2016, August

To the query what rewards (compensation and benefits) your organizations prefers mostly for the employees, their preference is more on direct cash rewards like salary, allowance rather than challenging job, interesting job, family allowance. This is reflected in Table 11.5.

Some more fringes enterprises offering are displayed in Table 11.4 a. This shows that some more benefits like lunch and medical reimbursement are provided to the employee's staffs.

Table 7: Some other fringes specified by some enterprises

Rewards or compensation

This survey has used the term reward in place of compensations and benefits. Anything given to employees in exchange of their services and devotion are terms here as reward. A typical model is presented here in Figure given under.

Table 8: classification of reward system

Reward			
Financial		Non-financial	
Direct	indirect	Job related	Environment related
Salary	Insurance	Interesting work	Working environment
Wages	Gratuity	Challenging work	Colleagues
Incentives	Pension	Recognition	Networking
Bonus	Educational allowance	Advancement opportunity through learning	Social image
Tiffin and lunch	holiday	Future prospects for new jobs and respects	Relation with seniors
Traveling allowance	Tours	Promotion	Relation with supervisors

An opinion was sought from different enterprises regarding different rewards mentioned in the Table given above. The opinion consists of likert's 7 point scale. They were to express their opinion in the form of least liking indicating 1 by their enterprises to 7 for most liking. It was found that enterprises like to offer all and they have positive attitude towards this type of flexible measures of rewards. However in ranking salary got top priority with a mean value of 6.59 and it was followed by allowance. Third rank was received by wages and fourth by provident funds. These are traditional measures which still are being liked by our entrepreneurs.

Table 11.5: Opinions of Enterprises for rewards (From 7 for high priority to 1 for least priority)

Headings	N	Mini-mum	Max-imum	Mean	Std. De-viation
Salary	44	1	7	6.59	1.064
Wages	39	1	7	5.72	2.114
allowances	41	1	7	6.17	1.447
Bonus	42	1	7	5.40	2.153
Gratuity	41	1	7	5.05	2.073
Sick leave	43	1	7	4.93	1.981
Home leave	45	1	7	4.96	1.858
Provident fund	43	1	7	5.70	2.144
Family allowance	35	1	7	3.60	2.354
Maternity leave	43	1	7	5.28	1.906
Interesting job	39	1	7	5.03	1.646
Challenging job	40	1	7	5.10	1.676
Responsibility	44	1	7	5.59	1.661
Recognition	42	1	7	5.45	1.565
Advancement opportunity	40	1	7	5.15	1.833
Working condition	42	1	7	5.29	1.642
Good team	46	1	7	5.46	1.643
Good manager	45	1	7	5.44	1.686
Good supervisors	44	1	7	5.48	1.621
Valid N (list wise)	5				

Source: Field Study, 2016, August

Safety and health measures

Regarding safety and health 37 enterprises (72%) have stated that they have provisioned this. Their answers to this are of mixed nature. Few have stated insurance, others few have stated proactive measures and awareness. The list is presented in the Table 11.6. On the analysis some sorts of precautions were found to be used by most of the all the enterprises.

Conclusion

With the inception of scientific management theory, focus seems to be given to relate pay and performance. The reward was defined narrowly to the pay and wages. Later behaviorist tried to include job related and environment related factors in the list of reward. The culmination of reward systems become total rewards system and become strategic. Reward system in the developed countries is more strategic, based on total reward system. In the case of developing countries they offer some direct pay like salary and wages, and some fringes. Such reward system lacks in developing countries.

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The Checklist for System and Software Product Quality Implied in the Product Quality Model of ISO/IEC 25000 Series SQuaRE

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Abstract

This paper critically reviews the product quality model of ISO/IEC 25000 Series SQuaRE. This paper proposes the principle of one view which states that a software quality model should correspond to one and only one software quality view. This paper also proposes a software quality view model composed with end view, activity view, means view, intrinsic view, and contingency view. This paper converts the measures of product quality to check items for developers or maintainers, and classifies them into those regarding data processing (valid, correct, and efficient), data interface, user interface (information providing, data inputting, process controlling, and presentation/appearance/composite), composite, software engineering (architecture, coding, and diagnosis/testing), system (capacity, runtime behavior, and operation management), and software activity. The results show the root cause of the discordance among characteristics, sub-characteristics, and measures of the product quality model and how to overcome the problem.

Keywords:

Software Quality, ISO/IEC (The International Standard Organization/The International Electro-technical Commission) 25000 Series, SQuaRE (Systems and software Quality Requirement and Evaluation), Software Product Quality Model, Checklist for Software Quality

Introduction

ISO/IEC 25000 Series SQuaRE defines three software quality models (quality in use, product quality, and data quality) and three views (internal, external, and in-use). Quality in use model rests on in-use view, and product quality model rests on both internal view and external view simultaneously. The product quality model of has 8 characteristics (compatibility, functional suitability, maintainability, performance efficiency, portability, reliability, security, and usability), 31 sub-characteristics, and 86 measures.

Koh [2016] proposes a model of views regarding software quality [7]. He also introduces the notion of software activity. In this paper, software activity is defined as the activity which is performed on the software product by a person or a group of persons. Among 8 product quality characteristics, usability, portability, and maintainability are directly related with software activities such as using, transferring, and modifying, respectively. Koh and Whang [2016] call such characteristics activity quality characteristics [6]. They also suggest to use the suffix '-ability' only for the software activity characteristic to make it clear whether the resulting characteristic is activity quality characteristic or not. In this paper, activity view is added to Koh [2016]'s software quality view model as follows:

- **End view**: It represents the effort to find out what the software product should be good for. The quality characteristic of this view corresponds to the effect of good quality of the software product.

- **Activity view**: It represents the effort to identify the types of activities for which a software product should be good. It focuses on the activity itself or the immediate effect of the activity.

- **Means view**: It represents the effort to make the software product good for various ends. The characteristic of this view corresponds to the cause of desirable effects.

- **Intrinsic view**: It represents the effort to find out intrinsic characteristics which facilitate software activities.

- **Contingency view**: It represents the effort to find out non-intrinsic characteristics such that the degree to which they facilitate software activities varies depending on contingencies or contexts.

SQuaRE mixes the characteristics and measures of intrinsic view, contingency view, and activity view into the product quality model to provoke discords, conflicts, and confusions. It even does not distinguish the characteristics of system and those of software product clearly to make worse. In this paper, this issue is addressed.

Disaccord among characteristics of product quality model

SQuaRE defines usability of product quality model as 'the degree to which a product or system can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use' [1] [ISO/IEC 25010:2011, p.12][2]. SQuaRE defines quality in use as 'the degree to which a product can be used by specific users to meet their needs to achieve specific goals with effectiveness, efficiency, freedom from risk and satisfaction in specific contexts of use'[ISO/IEC 25010:2011, p.8][2]. It explains that 'usability can either be specified or measured as a product characteristic in terms of its sub-characteristics, or specified or measured directly by measures that are subset of quality in use' and that 'context of use is relevant to both quality in use and some product quality characteristics'[ISO/IEC 25010:2011, pp.9, 12][2]. So, it is logical to interpret usability as a triple of effectiveness, efficiency, and satisfaction associated with using a software product.

SQuaRE also emphasizes that '*each of these types of user has needs for quality in use and product quality in particular contexts of use*': For example, maintainers have needs for effectiveness, efficiency, satisfaction, freedom from risk, reliability, security context coverage, learnability, and accessibility in maintaining or porting [ISO/IEC 25010:2011, pp.5-7][2]. In product quality model, however, SQuaRE distinguishes using, maintaining and porting, and defines usability, maintainability, and portability separately.

Beside usability, SQuaRE defines learnability (ULe)[2], maintainability, analyzability (MAn), modifiability (MMd), testability (MTe), portability, adaptability (PAd), and installability (PIn) as the multiple-valued characteristics composed with effectiveness, efficiency, satisfaction, and/or freedom from risk (refer Table 1). It is noticeable that such characteristics are those associated with software activity such as learning (or studying), maintaining (modifying, or changing), analyzing, testing, transferring, adapting, or installing (and/or uninstalling). This implies that SQuaRE distinguishes activity characteristics with other characteristics.

Table 1 - Product quality characteristics and sub-characteristics

Characteristic Sub-Cha.	Key Words	Activity Involved
Compatibility	Sharing same environment	--
CCo	Performing required functions efficiently	--
CIn	Exchanging and using information	--
Functional Suit.	Functions meeting stated and implied needs	--
FAp	Facilitating the accomplishment of specified tasks and objectives	--
FCp	Covering specified tasks and user objectives	--

1 In this paper, italic font emphasizes that corresponding part is quoted with no or only slight changes from the cited literature.

2 The first letter of abbreviation of sub-characteristic denotes its super-characteristics. In this case, 'U' denotes usability.

FCr	Providing correct results	--
Maintain-ability	Effectiveness, efficiency	Modifying
MAn	Effectiveness, efficiency	Analyzing
MMd	Effectiveness, efficiency	Modifying
MMo	Being composed of discrete components	--
MRe	Reusing an asset	*Reusing*
MTe	Effectiveness, efficiency	Testing
Perfor-mance Eff.	The amount of resources used	--
PCa	Maximum limits of parameter	--
PRu	Amount and types of resources used	--
PTb	Times and throughputs rates	--
Portabil-ity	Effectiveness, efficiency	Transferring
PAd	Effectiveness, efficiency	Adapting
PIn	Effectiveness, efficiency	Installing
PRe	Replacing another product (in the sense of similarity)	--
Reliabil-ity	Performing specified functions	--
RAv	Being operational and accessible when required	--
RFt	Operating as intended under presence of faults	--
RMa	Meeting the needs for reliability under normal operation	--
RRe	Recovering data, re-establishing the desired state	*Recovering*
Security	Protecting information and data	--
SAc	Tracing the entity of an action uniquely	*Tracing*
SAu	Proving the identity of a subject or resource	*Proving*
SCo	Data are accessible to only the people authorized	--
SIn	Preventing unauthorized access or modification	--
SNo	Preventing repudiation of events or actions	Proving
Usability	Effectiveness, efficiency, satisfaction	Using
UAc	Characteristics and capabilities of people	
UAp	Recognizing appropriateness	--
UEp	Protecting users against making errors	
UIn	Pleasing and satisfying interaction	
ULe	Effectiveness, efficiency, satisfaction, freedom from risk	Studying
UOp	Easiness	*Operating*

Abbreviation of sub-characteristics: CCo=Co-existence, **CIn**=Interoperability, **FAp**=Functional appropriateness, **FCp**=Functional completeness, **FCr**=Functional correctness, **MAn**=Analyzability, **MMo**=Modularity, **MRe**=Reusability, **MMd**=Modifiability, **MTe**=Testability, **PAd**=Adaptability, **PCa**=Capacity, **PIn**=Installability, **PRe**=Replaceability, **PRu**=Resource utilization, **PTb**=Time behavior, **RAv**=Availability, **RFt**=Fault tolerance, **RMa**=Maturity, **RRe**=Recoverability, **SAc**=Accountability, **SAu**=Authenticity, **SCo**=Confidentiality, **SIn**=Integrity, **SNo**=Non-repudiation, **UAc**=Accessibility, **UAp**=Appropriateness recognizability, **UEp**=User error protection, **UIn**=User interface aesthetics, **ULe**=Learnability, **UOp**=Operability,

Table 2 - Influence and dependency of contingency quality characteristics: A subjective opinion.

Characteristic	**Sub-characteristic**	**Influences**	**Depends on**
Compatibility	Co-existence	Installing	System (software portfolio)
	Interoperability	Installing	System (software portfolio)
Functional suitability	Functional appropriateness	Using	Social and organizational environment (work and task)
	Functional completeness	Using	Social and organizational environment (work and task)
	Functional correctness	Using	Social and organizational environment (work and task)
Performance efficiency	Capacity	Using	System (data volume and structure)
	Resource utilization	Using	System (data volume and structure)
	Time behavior	Using	System (data volume and structure)
Reliability	Availability	Using	System
	Fault tolerance	Using	System
	Maturity	Using	System
	Recoverability	Using	System
Usability	User error protection	Using	System, environment (work and task, physical)
	User interface aesthetics	Using	System (interface device), physical environment (illumination, noise, etc.)

Source: Koh [2016]

Learning, however, is not a software activity. Learning means '*gaining knowledge or skill by studying, from experience, from being taught* [Oxford Learner's Dictionary].' A user may learn about the product in the course of using it without involving studying at all. That is, the user's knowledge or skill about a product may be increased as the by-product of using

it. Learning is not, a component-activity of using: Learning in the sense of gaining knowledge or skill is not a type of activity, but is a type of mental phenomenon that occurs inside of a person and that cannot be observed externally.

Recognizing appropriateness is another example of mental phenomenon which occurs inside a person. It may happen in the course of studying or using. It can happen without involving any specific observable activity. Moreover, one may recognize the appropriateness of a product by its advertisements, word-of-marketing, active information seeking, or simply seeing that others use the product. Learnability and appropriateness recognizability (UAp) are not activity quality characteristics. It is even doubtful whether learnability and appropriateness recognizability may be included in software quality model or not.

On the other hand, the term studying typically means '*the activity of learning or gaining knowledge'* [Oxford Learner's Dictionary] or '*spending time learning about a particular subject or subjects'* [Collins Cobuild Advanced Learner's English Dictionary] [1]. It specifies and emphasizes 'spending time to perform the activity.' Studying is a type of software activity and it seems better to substitute learnability with study-ability.

Operability (UOp), recoverability (RRe), non-repudiation (SNo), accountability (SAc), accountability (SAc), and reusability (MRe) also involve activities such as operating and controlling a product, recovering data and re-establishing the desired state, proving that actions and events have taken place, tracing the actions of an entity uniquely to the entity, proving the identity of a subject or resource, and reusing assets, respectively. Operating and controlling a product is also software activity. The other activities, however, are typically performed on the system. This issue is beyond the scope of this paper and is not addressed further. It is noticeable, however, that it is possible to measure the satisfaction of the performer who has performed the corresponding activity.

On the other hand, it is not possible to measure satisfaction associated with the other characteristics. For example, the subject of providing function in functional suitability is the product itself. It is obvious that a software product cannot feel the emotion of satisfaction.

Koh [2016][7] argues that characteristics of product quality model have cause-and-effect relationships among them (refer Table 2) and that they should not be grouped in a single model. The table may be misleading in details. The main point of the argument, however, seems valid.

Disaccord between characteristics and their measures

Every measure of product quality model is a scalar defined to be the ratio of 'A/B' or '1-A/B'. As a matter of course, *usability measures are used to assess usability* [ISO/IEC 25023:2016, p.14][4]. SQuaRE, however, do not provide any hint regarding how to convert 22 scalar values of usability measures to the triple of effectiveness, efficiency, and satisfaction. It is obvious that simply summating singletons makes a singleton. How should the three different values of effectiveness, efficiency, and satisfaction be derived from 22 scalar values? This problem applies to every activity characteristic of product quality model.

The measures of product quality model can be converted to check items for developers or maintainers (refer Appendix). They are classified into those regarding data processing (valid, correct, and efficient), data interface, user interface (information providing, data inputting, process controlling, and presentation/appearance/composite), composite, software engineering (architecture, coding, and diagnosis/testing), system (capacity, runtime behavior, and operation management), and software activity. It is especially noticeable that there are items of activity view regarding developing/maintaining and installing.

All the items corresponding to usability are classified into user interface (more specifically, into information providing, data inputting, process controlling, and presentation/appearance/composite). Effectiveness of using activity, however, chiefly determined by valid and correct data processing. Efficiency is also strongly affected by efficient data processing. SQuaRE classifies all the items associated with data processing into functional suitability and performance efficiency.

In fact, most product quality measures have the means-and-end or cause-and-effect relationship with usability. SQuaRE's classification scheme gives wrong implication that user interface is the most important factor which affects usability.

Principle of one view

This paper proposes the following principle:

- **Principle of one view**: A software quality model should correspond to one and only one software quality view.

According to the principle, the measures of product quality model should be classified into, at least, those of means view and those of activity view. Those of means view can and should be divided into separate groups further according to their more specific views.

SQuaRE defines internal view and external view as *a* 'white box' view of software which addresses properties of the software product that typically are available during the development and is mainly related to static properties of the software' and 'a 'black box' view of the software which addresses properties related to the execution of the software on computer hardware and applying an operating *system,*' respectively [ISO/IEC 25030:2007, p.6][5]. By letting external quality and internal quality share the same model of characteristics, however, SQuaRE virtually let the distinction of internal view and external view be the issue restricted to measurement.

According to SQuaRE, 21 measures can be measured only externally. If SquaRE is right, this implies that these measures are strongly affected by the system, which means that they as the measures of the software product quality are of low validity. The logical conclusion is that they are appropriate for the measures of system quality rather than for the measures of software quality.

According to SQuaRE, 3 measures (MMo-2-S: cyclomatic complexity adequacy, MMo-2-S: coding rules conformity, and SIn-3-S: buffer overflow prevention) can be measured only internally. SQuaRE presumes that the product quality is affected by the target computer system and that quality in use is affected by both the human-computer system including the target computer system and the particular context in which the product is being used [ISO/IEC 25010:2011, pp.4-5; ISO/IEC 25022:2016, p.7][2,3]. However, the property of any system cannot be loaded on the measures measured internally. So, these 3 measures are solely for software quality and are of intrinsic view.

According to SQuaRE, the other 62 measures can be measured both internally and externally. SQuaRE adds following explanations [ISO/IEC 25023:2106][4]: Internal measures for performance efficiency are applicable to static design documents or source code. These measured values are able to be contained by estimation of theoretical calculation amount of designed algorithms, number of function calls or steps of executable code. However, applications of external measures for performance efficiency on intermediate executable prototype during design are helpful to understand actual gaps between internal and external measures and calibrate estimation for internal measures. Internal measures for usability are applicable to static mock-up of screen display, specification for usability design, a set of message text files, user manuals, source code for user interfaces and so on. However, applications of external measures for usability on intermediate executable prototype during development are helpful to understand actual gaps between internal and external measures. If available, application of quality in use measures to executable prototype during development is also very helpful. These explanations illustrate that the internal measurement and external measurements of these measures involves different forms of the software product.

A software program can take three distinctive types of entities: the source code, the executable (that can be executed on the target machine architecture), and the execution (the solution provided through running of the program-executable code on some hardware and is a model of some virtually constructed environment created to satisfy the intended requirements) [Younessi 2002, p.23][9]. For example, the failure (it is said to have occurred when the software product does not satisfy expectations), fault (an incorrect state entered by a program executable or an incorrect transformation undergone; it is characteristics of the executable code and does not necessarily cause software failure, which is also impacted by how the software is used), defect (an imperfection in the software engineering work product that require rectification), and bug (a defect that cause the generation of a fault; some defects such as the provision of a comment on the wrong line or in the wrong section of the source code do not generate faults in the executable) should be distinguished, although they are very closely related [Younessi 2002, pp.23-25][9]. They are associated with distinctive software entity

types. Hence, they should be defined distinctively in their concepts, and should be detected by distinctive ways. So the software quality measures are.

Conclusions

This paper proposes a software quality view model consisted with end view, activity view, means view, intrinsic view, and contingency view. Among three entity types associated with a software product, the source code and executable are associated with intrinsic view while the execution is basically associated with contingency view. Especially, the emergent properties of executions due to the system on which it runs are contingent, since multiple distinctive executions may be generated from a source code or executable.

This paper critically reviews the product quality model of ISO/IEC 25000 Series SQuaRE and converts the measures of product quality to check items for developers or maintainers. The items are classified into those regarding data processing (valid, correct, and efficient), data interface, user interface (information providing, data inputting, process controlling, and presentation/appearance/composite), composite, software engineering (architecture, coding, and diagnosis/testing), system (capacity, runtime behavior, and operation management), and software activity.

It is especially noticeable that 2 measures of modifiability (MMd-1-G: modification efficiency, MMd-3-G: modification capacity) and 1 measure of installability (PIn-1-G: installation time efficiency) measure the time duration to modify or install, respectively. They are virtually redundant with the general efficiency measure of quality in use.

Quality in use model extends the term ‘user’ to include various types of stakeholders such as primary user (person who interact with the system to achieve the primary goals), secondary users (person who provide support, for example. content provider, system manager/administrator, security manager, maintainer, analyzer, porter, installer), and indirect user (person who receives output, but does not interact with system) [ISO/IEC 25010:2011, pp.5-6]. As a matter of course, ‘use’ in quality in use model includes various activities that these stakeholders perform, for example, such as maintaining and porting.

The effectiveness of developing or maintaining activity as a whole is reflected in the current state of the product. So, most product quality characteristics and measures can be regarded as those for the effectiveness of developing or maintaining activity as a whole. The effectiveness of individual developing or maintaining activity cannot be measured from the current state of the product alone. The items which are regarded to be associated with the effectiveness of individual developing or maintaining activity are classified to be of activity view.

Sixty two product quality measures are defined to be both external and internal. However, this paper proposes the principle of one view which states that a software quality model should correspond to one and only one software quality view. As failure, fault, defect, and bug are defined and detected distinctively, for example, the measures and associated quality characteristics should be redefined conceptually and operationally according to each of associated views. The fact that characteristics and measures of different views are mixed in a model is the root cause of the discordance among characteristics, sub-characteristics, and measures of SQuaRE’s product quality model.

External view and in use view are identical essentially in the sense that they are regarding the execution. It seems the reason of why some product quality characteristics are defined almost redundantly with quality in use and why their measures are not congruent with the characteristics that are supposed to be measured by them. The software model presented in this paper is much clearer conceptually and free from overlap.

It seems logical to start by elaborating the software quality models of end view. The valid quality models of end view will provide answers to what the software product should be good for. It may be necessary to classify end view further. Then, it will become possible to construct valid quality models of means view. The valid quality models of means view should provide answers to how to increase the end view quality of the software product. As the result, stakeholders of the software product will be able to accomplish their ends associated with the product effectively, efficiently, and satisfactorily.

References

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[3] ISO/IEC 25022:2016, *Systems and Software Engineering – Systems and Software Quality Requirements and Evaluation (SQuaRE) – Measurement of Quality in Use*, ISO, 2016, 5.7.

[4] ISO/IEC 25023:2016, *Systems and Software Engineering – Systems and Software Quality Requirements and Evaluation (SQuaRE) – Measurement of system and Software Product Quality*, ISO, 2016, p14.

[5] ISO/IEC 25030:2007, *Systems and Software Engineering – Systems and Software Quality Requirements and Evaluation (SQuaRE) – Quality Requirements*, ISO, 2005, p.6..

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Appendix: Check list derived from the measures of product quality model

Data processing - Valid

(FAp-1-G-B-HR: [3] Functional appropriateness of usage objective) Does every function required by the user provide appropriate outcome to achieve a specific usage objective?

(FAp-2-G-B-HR: Functional appropriateness of system) Does every function required by the user to achieve their objective provide appropriate outcome?

(FCp-1-G-B-HR: Functional coverage) Has every specified functions been implemented?

Data processing - Correct

(FCr-1-G-B-HR: Functional correctness) Does every function provide the correct results?

Data processing - Efficient

(PRu-1-G-E-HR: Mean processor utilization) Is the processor time used to execute a given set of tasks compared to the operation time adequate?

(PRu-2-G-E-R: Mean memory utilization) Is the memory used to execute a given set of tasks adequate compared to the available memory?

(PRu-3-G-E-R: Mean I/O devices utilization) Is the I/O device busy time used to perform a given set of tasks is adequate compared to the I/O operation time?

(PRu-4-S-E-UD: Bandwidth utilization) Is the bandwidth utilized to perform a given set of tasks adequate compared to the operation time?

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3 The first part is the abbreviated alphabetic code representing the sub-characteristic it belongs to. The second part is serial number. The third part denotes G (generic: *can be used whenever appropriate*) or S (specific: *can be used when relevant in a particular situation*). These first 3 parts constitute the identity code of quality measures used in ISO/IEC 25023:2016. The fourth part denotes I (internal view), E (external view), or B (both). The last part denotes HR (*highly recommended: use this measure always*), R (*recommended: use this measure when appropriate*), or UD (*used at user's discretion: use this measure as a reference when developing a new quality measure because the measure has unknown reliability*).

Data interface

(CIn-1-G-B-HR: Data formats exchangeability) Is every specified data format exchangeable with other software or system?

(CIn-2-G-B-R: Data exchange protocol sufficiency) Is every specified data exchange protocols is supported?

(CIn-3-S-B-HR: External interface adequacy) Is every specified external interface (interface with other software and systems) functional?

(PRe-4-S-E-UD: Data reusability/import capability) Can the existing data be used after replacing previous software product by this one?

User interface – Information providing (including by off-line materials)

(UAp-1-G-B-HR: Description completeness) Is every usage scenario described in the product description or user documents?

(UAp-2-S-B-UD: Demonstration coverage) Does every task have demonstration features for users to recognize the appropriateness?

(UAp-3-S-B-UD: Entry point self-descriptiveness) Does every commonly used landing page on a website explain the purpose of the website?

(ULe-1-G-B-HR: User guidance completeness) Is every function explained in user documentation and/or help facility to enable the user to apply the function?

(ULe-3-S-B-R: Error messages understandability) Is an error message that states the reason why the error occurred and how to resolve it given, whenever this is possible?

(ULe-4-S-B-UD: Self-explanatory user interface) Does every information element and step presented to the user enable first-time user to complete common tasks to be completed by a first time user without prior study or training or seeking external assistance?

(UOp-2-G-B-R: Message clarity) Does every message from a system convey the right outcome or instructions to the user?

(UOp-5-S-B-UD: Monitoring capability) Can every function state be monitored during operation?

User interface – Data inputting

(SIn-3-S-I-UD: Buffer overflow prevention) Has every memory access with user input in software modules been done bounds checking for preventing buffer overflow?

(UEp-1-G-B-HR: Avoidance of user operation error) Is every user action and inputs protected against causing any system malfunction?

(UEp-2-S-B-HR: User entry error correction) Is every user entry error with an identifiable cause provided with a suggested correct value?

(UEp-3-S-B-R: User error recoverability) Can every user error be corrected or recovered by the system?

(ULe-2-S-B-R: Entry fields defaults) Is every entry field that could have a default value automatically filled with the default value?

(UOp-9-S-B-UD: Input device support) Can every task be initiated by all appropriate input modalities (such as keyboard, mouse or voice)?

User interface – Process controlling

(UOp-3-S-B-UD: Functional customizability) Can every function and operational procedure be customized by a user for his convenience?

(UOp-6-S-B-R: Undo capability) Does every task that has a significant consequence provide an option for re-confirmation or un-do capability?

User interface – Presentation, appearance & composite

(UAc-1-G-B-R: Accessibility for users with disabilities) Can every potential user with specific disabilities successfully use the system (with assistive technology if appropriate)?

(UAc-2-S-B-UD: Supported languages adequacy) Is every needed language supported?

(UIn-1-S-B-UD: Appearance aesthetics of user interfaces) Is every user interface aesthetically pleasing in appearance?

(UOp-1-G-B-HR: Operational consistency) Does every interactive task have a behavior and appearance that is consistent both within the task and across similar tasks?

(UOp-4-S-B-UD: User interface customizability) Can every user interface element be customized in appearance?

(UOp-7-S-B-R: Understandable categorization of information) Is every information structure familiar to the intended users and convenient for their tasks?

(UOp-8-S-B-UD: Appearance consistency) Does every user interface with similar items have a similar appearance?

Composite

(CCo-1-G-E-HR: Co-existence with other products) Can every specified software products share the environment with this software product without adverse impact on their quality characteristics or functionality?

(PAd-1-G-E-HR: Hardware environmental adaptability) Is the product capable enough to adapt itself to different hardware environment?

(PAd-2-G-E-HR: System software environmental adaptability) Is the product capable enough to adapt itself to different system software environment?

(PAd-3-S-E-UD: Operational environment adaptability) Is the product capable enough to adapt itself to different operational environment?

(PRe-1-G-B-HR: Usage similarity) Can every user function of the replaced product be performed without any additional learning or workaround?

(PRe-2-S-B-R: Product quality equivalence) Is every quality measure satisfied after replacing previous software product by this one?

(PRe-3-S-E-R: Functional inclusiveness) Can every similar function easily be used after replacing previous software product by this one?

SW Engineering: Architecture

(MMo-1-G-B-R: Coupling of components) Is every component strongly independent and free from impacts from changes or computer program?

(MMo-2-S-I-UD: Cyclomatic complexity adequacy) Dose every software module have acceptable cyclomatic complexity?

(MRe-1-G-B-HR: Reusability of assets) Can every assets in a system can be reusable?

SW Engineering: **Coding**

(MRe-2-S-I-R: Coding rules conformity) Does every module conform to required coding rules?

SW Engineering: **Diagnosis and testing**

(MAn-2-S-B-R: Diagnosis function effectiveness) Does every diagnosis function meet the requirements of causal analysis?

(MAn-3-S-B-R: Diagnosis function sufficiency) There is every required diagnosis function?

(MTe-1-G-B-R: Test function completeness) Is every test function as specified?

(MTe-2-S-B-UD: Autonomous testability) Can every test which depends on other systems be simulated by stub independently?

(MTe-3-S-B-UD: Test restartability) Can every execution of test run be paused and re-started at desired points to check step by step?

System - Capacity

(PCa-1-G-B-R: Transaction processing capacity) Is the number of transactions able to be processed per unit time adequate?

(PCa-2-G-B-R: User access capacity) Is the number of users who can access the system simultaneously at a certain time adequate?

(PCa-3-S-E-UD: User access increase adequacy) Is the number of users who can be added successfully per unit time adequate?

(RFt-2-S-B-R: Redundancy of components) Is redundancy of components (the proportion of system components in installed redundantly to avoid system failure) adequate?

(PTb-1-G-B-HR: Mean response time) Is the mean time taken by the system to respond to a user task or system task adequate?

(PTb-2-G-B-R: Response time adequacy) Does the system response time meet the specified target?

(PTb-3-G-B-R: Mean turnaround time) Is the mean time taken for completion of a job or an asynchronous process adequate?

(PTb-5-G-B-R: Mean throughput) Is the mean number of jobs completed per unit time adequate?

System - Runtime Behavior

(MAn-1-G-B-HR: System log completeness) Does the system record adequately its operations in logs so that they are to be traceable?

(RAv-1-G-E-HR: System availability) Is system availability (the proportion of available time against the scheduled operational time) adequate?

(RAv-2-G-E-R: Mean downtime) Is mean downtime (the time the system stay unavailable when a failure occurs) adequate?

(RFt-3-S-E-UD: Mean fault notification time) Does the system report the occurrence of faults sufficiently quickly?

(RMa-2-G-E-HR: Mean time between failure: MTBF) Is MTBF during the system/software operation adequate?

(RMa-3-G-E-R: Failure rate) Is the average number of failures during a defined period adequate?

(PTb-4-G-B-R: Turnaround time adequacy) Does the turnaround time meet the specified target?

(RRe-1-G-E-HR: Mean recovery time) Is mean recovery time (the time for the software/system to recover from failure) adequate?

System – Operation Management

(PIn-2-G-E-R: Ease of installation) Can users or maintainers customize the installation procedure for their convenience?

(RRe-2-S-B-R: Backup data completeness) Is proportion of data item backed up regularly adequate?

(SAc-1-G-B-HR: User audit trail completeness) Is the audit trail concerning the user access to the system or data complete?

(SAc-2-S-B-R: System log retention) Is the system log adequately retained in stable storage?

(SAu-1-G-B-HR: Authentication mechanism sufficiency) Does the system authenticate the identity of a subject well?

(SAu-2-S-B-R: Authentication rules conformity) Is every required authentication rule established?

(SCo-1-G-B-HR: Access controllability) Is every confidential data item protected from unauthorized access?

(SCo-2-G-B-R: Data encryption correctness) Is every encryption/decryption of data item correctly implemented as stated in the requirement specification?

(SCo-3-S-B-UD: Strength of cryptographic algorithms) Has every cryptographic algorithm been well-vetted?

(SIn-1-G-B-HR: Data integrity) Is the data corruption or modification by unauthorized access adequately prevented?

(SIn-2-G-B-R: Internal data corruption prevention) Are the available prevention methods for data corruption adequately implemented?

(SNo-1-G-B-R: Digital signature usage) Is every event requiring non-repudiation processed using digital signature?

Activity view –Developing & Maintaining

(MMd-1-G-B-HR: Modification efficiency) How long was the time to completed modifications?

(MMd-2-G-B-HR: Modification correctness) Has every modification been implemented correctly?

(MMd-3-S-B-UD: Modification capability) Has every required modification been made within a specified duration?

(RFt-1-G-E-HR: Failure avoidance) Has every fault patterns been brought under control to avoid critical and serious failures?

(RMa-1-G-B-HR: Fault correction) Has every detected reliability-related fault been corrected?

(RMa-4-G-E-R: Test coverage) Is every system or software capability, operational scenario or function that is included in their associated test suites actually performed?

Activity view - Installing

(PIn-1-G-E-R: Installation time efficiency) How long is the actual installation time?

Table 2 - Influence and dependency of contingency quality characteristics: A subjective opinion.

Characteristic	**Sub-characteristic**	**Influences**	**Depends on**
Compatibility	Co-existence	Installing	System (software portfolio)
	Interoperability	Installing	System (software portfolio)
Functional suitability	Functional appropriateness	Using	Social and organizational environment (work and task)
	Functional completeness	Using	Social and organizational environment (work and task)
	Functional correctness	Using	Social and organizational environment (work and task)
Performance efficiency	Capacity	Using	System (data volume and structure)
	Resource utilization	Using	System (data volume and structure)
	Time behavior	Using	System (data volume and structure)
Reliability	Availability	Using	System
	Fault tolerance	Using	System
	Maturity	Using	System
	Recoverability	Using	System
Usability	User error protection	Using	System, environment (work and task, physical)
	User interface aesthetics	Using	System (interface device), physical environment (illumination, noise, etc.)

Source: Koh [2016]

Intelligent Design Thinking for Value Creation in the Digital Society

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Abstract

Today ICT has been got Inseparable sector of human life and emergence of new forms of communication, large networks of information and communication have become a new social spaces, unlimited spaces that affect relations, and social skills of people. Now digitization influences all aspects of our lives, individuals and communities. Digitization may make our lives better or worse.However, the digitization also has the potential to be involved in community development in the future. Now people are communicating properly with technology, machines, devices, networks and operating systems that deal with them daily. Digital society makes us able to connect anything to our mind. In this article we discuss the importance of understanding the impact of information technology and communications. And the main question of the article is how to value creation in the digital society.

Keywords: Digital Society, Value Creation, Design Thinking

Introduction

The concept of smart city, smart environment, and smart house has been recently introduced in our society. One of several definitions of smart cities is "use of intelligent computing technologies in order to be done municipal services more intelligent, more interconnected and more efficient- that includes management, education, health, public safety, real estate, transportation and facilities". The use of new technologies in business models and substructure of sectors is driven by the Internet and globalization.

In the past decade the increase using of technology in all sectors of society has put pressure on cities both economically and politically, to integrate the latest and best technology in their city development. As cities have gained more control over their development and progress in the 21st, faced with an extensive range of challenges and threats. Whereas cities play the main role of economic and social aspects all over the world, can be understood that why cities are key elements for the future.

Economic and social aspects including turbulent business environment, lack of resources, globalization and excessive competition, put substantial competitive pressures on many businesses. Rapid professional technology changes and increasing of global access to unlimited geographic markets allow consumers to have unlimited choices in their intended product selection. But to understand and control the products and services in response to network and rapid globalization has become hard and hard. Hence value creation for customers has become vital for any organization to have sustainable business in the future.

Analysts have predicted that internet products and new services of intelligent community will grow exponentially in the coming years. Digital society areas have caused to increase competitiveness in European countries and made the daily life easier. Also it will be led better service, huge savings and more careful use of resources. For example, relationships between objects which is one of the substructure conditions of a digital society, help patients to receive continuous cares, and companies to provide their resources best and make their work easier.

Today, it can clearly state that the digital society has dominated in many different areas and it's going to be recognized. Researchers and many organizations are trying to examine the influence of ICT growth on human societies. Also they're trying to propel communities into making intelligent by essential tools and substructure and to take advantage of all the capabilities in this field.

In digital society, Internet is not only a network of computers, but as it shown in figure 1 it has evolved into a network of any type and size devices such as vehicles, smart phones, household appliances, toys, cameras, medical instruments and industrial systems all connected to the global network, communicating and sharing information all the time.

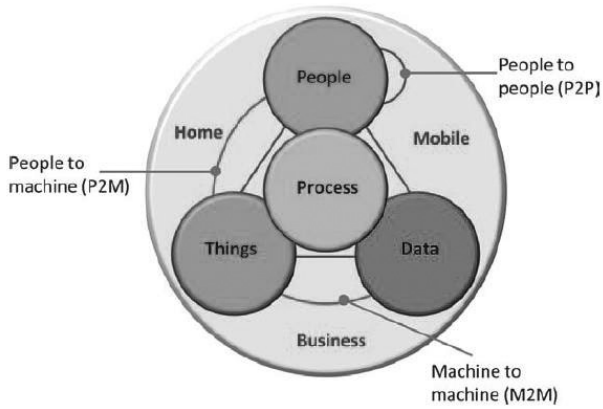

Figure1: internet of any things in digital society

Digital society had until recently different means at different levels of abstractions through the value chain, from lower level

Until recently digital society had different meanings at different levels of abstraction through the value chain. The digital society has been a "global concept" and requires a common definition. Considering the wide background and required technologies, such as sensing device, communication subsystem, data aggregation and pre-processing to create object sample and finally service presentation and provision, generating an unambiguous definition of the "digital society" is important.

The value of an artifact is not determined solely by its functionality. This problem has become more important in the 21st century in light of rapid globalization of markets and explosive networking of information. Market globalization has brought changes in industrial structures and has promoted international specialization of labor. Moreover, it intensifies severe price competition and widens economic disparity among nations. The word ‘‘commoditization’’ means transformation of differential goods or services into commodities [2]. In other words, a certain product with good functionality

loses its particularity and becomes an ordinary product because other products have identical functionality (perhaps at a lower price). Therefore, rather than considering mere functionality, producers must infer what would increase the value of their products to the likely users. Many manufacturing industries are rapidly shifting their attention to marketing and service businesses to increase their products' value [3]. Globalization therefore presents two conflicting goals: specialization to survive price competition and expansion of business activities to survive value competition.

In this paper, desin thinking solves problems that existing solutions are not able to solve them or have no value creation, by utilizing principles of creativity and methods that designers uses to solve their problems. Design thinking is undoubtedly one of the methods of Inventive Solving of problems that can be more efficient and effective than others in solving of challenging and complex issues, by using the unique principles and prototypes creating.

Background

As a review we can refer to recent researches. For example in 2016 Altinay and associates presented a study on how to create social value through Tourism Company, and also Paz and associates presented an intelligent lighting control system on a smart city. At the same year Rojas and associates presented an intelligent system that is used to collect and retrieve required information for internet based designing and management of software project.

The new wave of innovation has been a review on operating systems of smart city. In 2017, Zhuhadar and associates made a review on intelligent operating systems used in smart city. In their opinion new wave of human innovations in this area is human abilities in communicating with new machines, and information that is between them (human and machines).

By 2020 we will see the development of integrated and branded huge cities with mesh networks. It is expected that more than 60 percent of the world population will live in urban areas by 2025. This process of urbanization will have divergent effects and influence the future of personal life. The rapid expansion of cities, getting cities larger by increasing population, and substructure development enforced cities borders to be extended toward the outside and merged the small towns around and formed huge cities with population of over 10 million people.

In 2023 there will be more than 30 megacities in the world, which 55 percent of it will be in developing countries; India, China, Russia and Latin America. This situation will lead to the evolution of smart cities with eight smart features including smart economy, smart buildings, smart mobility, smart energy, smart ICT, smart planning, smart citizen and smart government.

Role of the government will be crucial for establishment of digital society. Urban operations is running day to day and creation of urban development strategies will be guided towards using digital society.

History of axiology

Historically in Europe, the first academic investigation of value was undertaken by sages of ancient Greece. Axiology, from the Greek ''axios'' (worthy, valuable) and ''logos'' (discourse, reasoning), is the discipline that deals with values in a systematic way. Nevertheless, the name axiology has been introduced only recently, not earlier than the beginning of the 1900s; ever since it has become common in academic essays. Figure 2 presents an outline of the genealogy of Axiology in the West from ancient Greek era to the present by showing important persons or institutions along with some keywords.

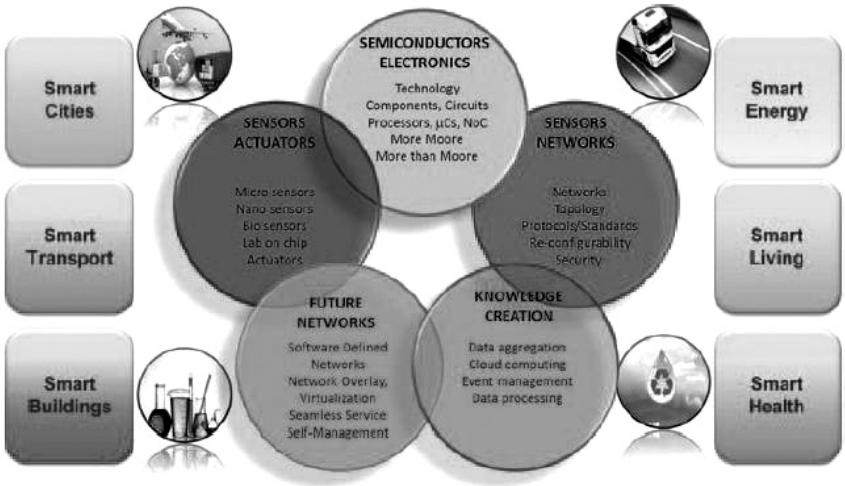

Figure 2: required conditions for creating digital city and society

In the 18th century, on the other hand, philosophers started to study the subjectivity of values. Epistemology [8] (or Theory of Knowledge) is a branch of philosophy concerned with the nature of knowledge (such as truth, belief, and justification). Kant founded German Epistemology [9]. He integrated Rationalism, which had been originated by Descartes, and the Empiricism of Locke [10], Bacon [11], and Hume [12]. Although Kant's thought is difficult to explain in detail here, humans form perceptions using natural abilities of sensibility and understanding. Humans also have a scheme for understanding the world: perception does not follow objects, but objects follow perception. His thought passed to Rickert, who established Wertphilosophie, which examines human value judgment [13], to Hegel, who insisted on absolute idealism according to a dialectic [14]. His thought affected that of Husserl, who is known as a founder of Phenomenology [15], by which values can be treated as intersubjective phenomena rather than subjective judgments.

Subsequently, some philosophers after the late 19th century mounted radical challenges of historical assumptions to values such as objectiveness and subjectiveness. Nietzsche vehemently denied the objectivity of values with his idea of Nihilism [16]. Wittgenstein insisted that all traditional philosophical problems such as virtue, value, and freedom are nothing but linguistic problems [17]. Their challenges could be understood as Metaphilosophical or Meta-knowledge-related approaches to values.

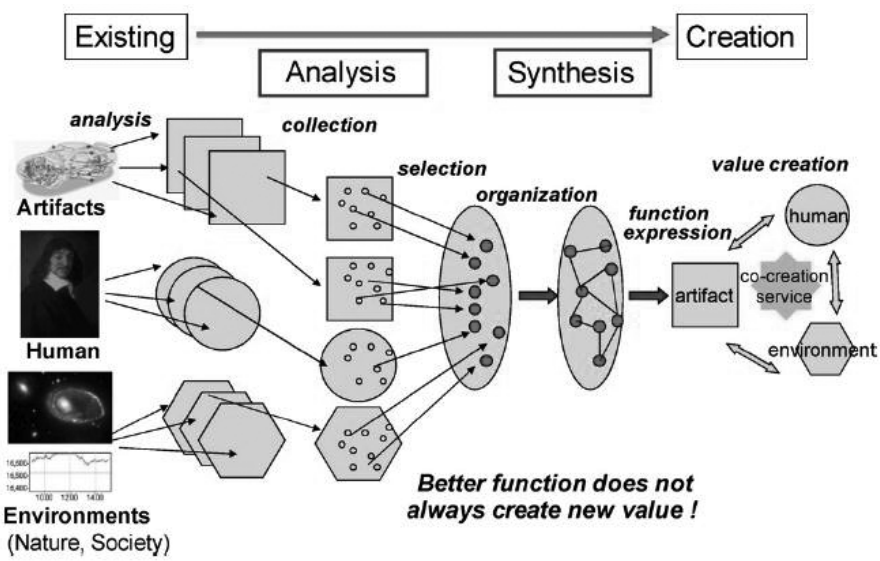

Figure 3: From analysis of existing things to value creation

As depicted in Figure 3, the creation of an artifact begins with acquisition of knowledge about existing things; it starts with obtaining knowledge about the existing environment (natural and social), knowledge about human beings, and existing artifacts [18]. Creation is accomplished through analyses of comprehensible knowledge, even if it is incomplete. Disciplines that cover these objects are regarded as natural sciences for existing nature, social science for existing society, humanities for existing humans, and engineering for existing artifacts. For creation of a new artifact, it is necessary to obtain a set of knowledge by collecting and selecting these acquired pieces of knowledge. It must be structured to obtain an attribute through connection of knowledge. In other words, the artifact is embodied by structure. In general, several possible combinations of connections or potential solutions can satisfy the requirements; in some cases, their number might be nearly infinite. Therefore, a common practice is to introduce an objective function and seek the optimal structure from among possible structure solutions

Fuzzy logic

Fuzzy logic is a form of many-valued logic in which the truth values of variables may be any real number between 0 and 1. By contrast, in Boolean logic, the truth values of variables may only be the "crisp" values 0 or 1. Fuzzy logic has been employed to handle the concept of partial truth, where the truth value may range between completely true and completely false. Furthermore, when linguistic variables are used, these degrees may be managed by specific (membership) functions [19].

Humans and animals often operate using fuzzy evaluations in many everyday situations. In the case where someone is tossing an object into a container from a distance, the person does not compute exact values for the object weight, density, distance, direction, container height and width, and air resistance to determine the force and angle to toss the object. Instead the person instinctively applies quick "fuzzy" estimates, based upon previous experience, to determine what output values of force, direction and vertical angle to use to make the toss.

Linguistic variables

While variables in mathematics usually take numerical values, in fuzzy logic applications non-numeric values are often used to facilitate the expression of rules and facts.

A linguistic variable such as age may accept values such as young and its antonym old. Because natural languages do not always contain enough value terms to express a fuzzy value scale, it is common practice to modify linguistic values with adjectives or adverbs. For example, we can use the hedges rather and somewhat to construct the additional values rather old or somewhat young.

Fuzzification operations can map mathematical input values into fuzzy membership functions. And the opposite de-fuzzifying operations can be used to map a fuzzy output membership functions into a "crisp" output value that can be then used for decision or control purposes.

Process

- Fuzzify all input values into fuzzy membership functions.

- Execute all applicable rules in the rulebase to compute the fuzzy output functions.

- De-fuzzify the fuzzy output functions to get "crisp" output values.

Method

We amuse the Smart Society model that product and service producers as well as customers are defined independently of their values. The objectives and environment are clearly specified. The model can be described completely using a closed system. However, in most cases, too many feasible solutions exist, which engenders combinatorial explosion and creates so-called NP-hard problems. Therefore, it is necessary to develop efficient and robust search methods to identify optimal solutions. In the real world, this model can apply to mass-produced products or routine services in smart city. In mass production, a designer determines the specification of a product based on available information about the environment (e.g., consumers' average demand or production costs) in advance. Consequently, the designer treats the information as complete information. In a routine service such as a fast-food service, the service must always be provided in the same way. Figure 4 shows the proposed value creation model in smart society.

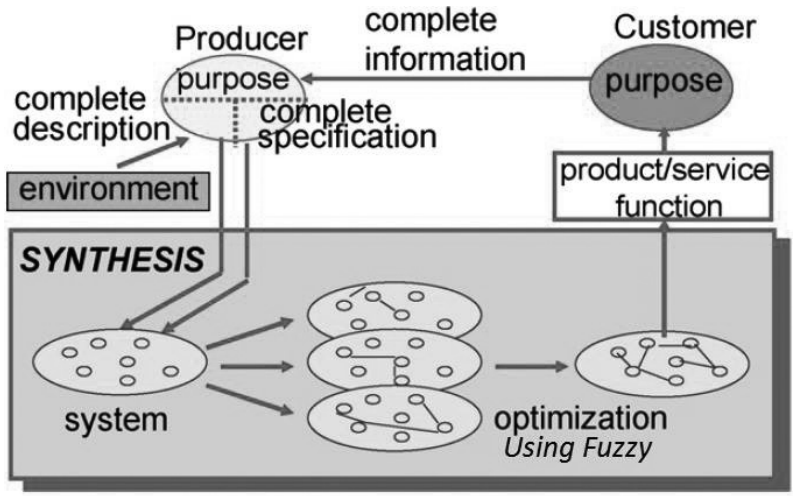

Figure 4: Proposed value creation model in smart society

The figure 4 shows that producers, customers, and products and services in smart society that are treatable as agents. The value for the product or service provider (producer) and receiver (customer) can be specified independently and the environment can be determined in smart society. The model can be described as a closed system. The problem to be addressed is the search for the optimal solution using Fuzzy Logic.

Experimental result

For investigations of proposed Model, reveal concerns about services: customers' demands, satisfaction, evaluation, customization, and recommendation. In addition to the problem of discerning individual customers' profit, the value of a service in a smart society emerges through dynamic interaction among producers and consumers. Ueda et al. examined service diffusion in a society considering consumers' lifestyles and network externalities [18,20,21]. In this section our model is compared with Ueda Model, and figure 5 presents results obtained using each model: the number of each case corresponds to that of each value creation model. The producer can gain the greatest profit under a predictable service environment in the Proposed Model (because of Using Fuzzy Method).

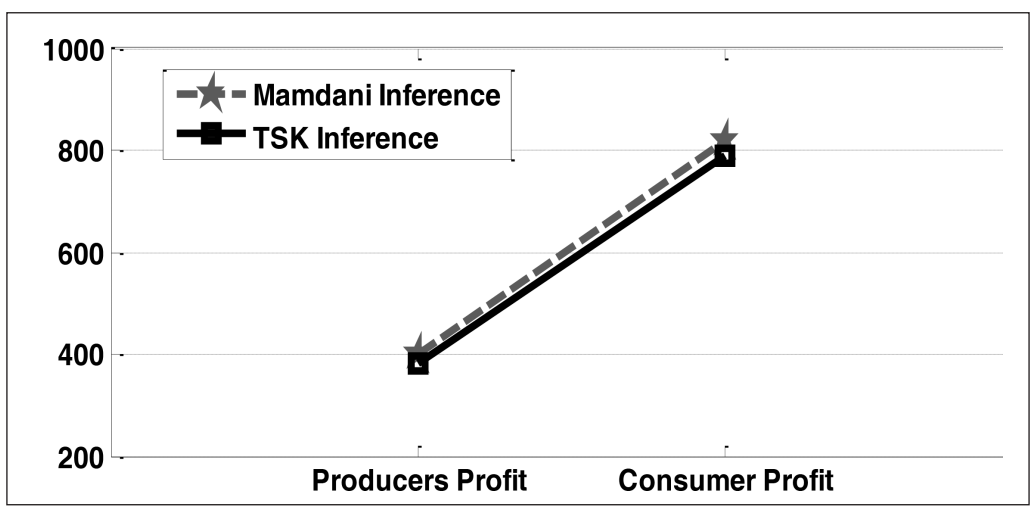

Figure 5 : Producer's profit, consumers' profit and their total Demand in value creation models

There are 2 types of fuzzy inference systems: Mamdani and Sugeno or Takagi-Sugeno-Kang (TSK). In another simulation we study the effect of these two types of fuzzy inference system in the proposed model. For this purpose the benefits of the consumers and the producers (according to previous simulation) have been measured by different inferences in fuzzy logic. The results shown in figure 6.

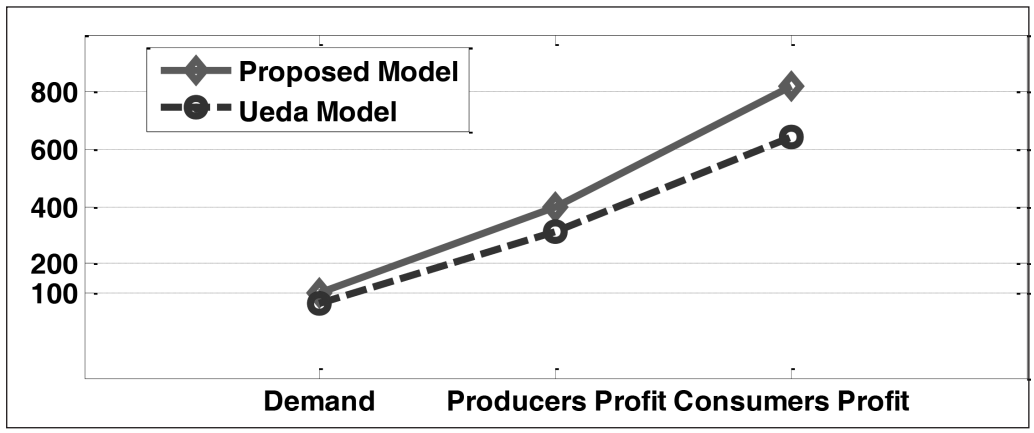

Figure 6 : Producers and consumer Profit by Mamdani and TSK Fuzzy Inference in Proposed Model

In this figure determined that Mamdani inference system than TSK inference system used in fuzzy system of proposed model has more profit for consumers and producers. Earned profit shown in table 1.

Table 1 : Producers and consumers Profit by Mamdani and TSK Fuzzy Inference in Proposed Model

	Producers Profit	**consumer Profit**
Mamdani Inf.	400	820
TSK Inf.	380	790

Conclusion

Fuzzy Logic can help our model to reach better performance in value creation in smart society. To evaluate the efficiency of the proposed method, the proposed model was compared to Ueda method. In this case 3 criteria has been used include producer's profit, consumer's profit and their total Demand. In conducted simulation determined that proposed method could create better profit criteria for consumers and producers in digital society because of using fuzzy logic.

For improvement of service productivity, we must address not only efficiency or optimization of service provision but also expansion of the value of services. To this end, we must pay more attention to the concept of valuation and the value mechanism in a smart society. Furthermore, sustainability is expected to be a good target for studies of services because individual happiness and the overall purpose (environmental and social sustainability) were solved simultaneously through dynamic interaction among various stakeholders. Recommendation and mass customization are also important topics in recent service studies in response to rapidly increasing customer purchasing and demand data. For those purposes, intelligent methods such as Bayesian networks or Collaborative Filtering that can calculate customers' preferences play important roles. Moreover, those problems are applicable to both service and manufacturing businesses.

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Are Critical Success Factors of BI Systems Really Unique?

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Abstract

Business intelligence has been attracting much attention these days. Despite such popularity of BI systems, it is widely known that about a half of BI system projects have failed. To grasp why many BI projects end in failure and what factors would make BI projects less failure-prone, a number of BI studies were made to produce a variety of CSFs. However, there is a paucity of information on whether these CSFs are distinctive from those of typical information systems. In addition, though there have been a number of similar types of BI systems such as decision support systems and executive information systems in existence, there was no study to determine whether there is ever a discrimination between CSFs of BI systems and the similarly-titled systems. This study is to answer these questions using a literature review analysis. The findings of our study are expected to be helpful in a successful implementation of BI systems.

Keywords:

Business Intelligence, Critical Success Factors, Decision Support Systems, Executive Information Systems, Date Warehousing, Data Mining

Introduction

Business Intelligence (BI) system is an information system that enables users to obtain a variety of insightful business information through the application of analytic techniques [12, 30, 28]. For the purpose of making decisions more intelligently and much faster, many firms have attempted to develop and deploy it [6].

Despite its prevalence, it is not as much used or productive as it is thought to be. Many BI projects are reported to end in failure and a number of BI systems deployed are left unused[9, 21, 22, 35, 43, 11] pointed out the uncertainty in return on BI investment.

To identify key areas where *things must go right* for an endeavor to become successful, a critical success factor approach had been proposed by[32]. Since its first use in defining information needs of chief executives [32], it has been used extensively in a variety of problem domains, especially project-style undertakings such as strategic [24], software development [17, 27, 40]

To increase the chance of BI success, a number of researchers have studied to identify a set of critical

success factors for BI projects [18, 19]. Factors identified in their studies include management support, well-established BI business case, and high quality of data, etc.

One major problem with CSF studies is that a set of CSFs identified in one study may be different from those of the other, depending upon research method or study domain [17]. This problem is making it difficult for use to reach common ground in BI CSFs. Though a systematic review of CSFs was ever made in domain of enterprise resource planning [28] and software projects [17, 27], a systematic review of BI CSFs was not made yet.

In addition, there exist a number of similar types of information systems, including decision support systems, executive information systems, or data warehousing. One spontaneous research question is whether there exists any difference between CSFs of BI and the other types. Two research questions of our study are 1) Whether BI CSFs are different from those of typical information systems? 2) Whether there is a meaningful difference between CSFs of BI and those of the other similarly-titled systems.

In order to achieve this, we focus on establishing a framework for cross-checking results of different CSF studies and, based upon this framework, comparatively evaluating results of CSF studies in software project, BI systems, and other BI-like systems, through literature review analysis.

Literature review

Business intelligence and related systems

Conceptualizing an artifact may be unusually difficult in some technology-driven fields. It is because the continuing advance of new technologies or the abrupt disappearance of some falling-behind technologies happens very often. These words fitly apply to business intelligence. Business intelligence has gone through the ups and downs of many related technologies or artifacts, such as decision support system, executive information system, OLAP, etc.

Accordingly, how BI is conceptualized differs from one researcher to another[3] understood all applications aiming to support or improve managerial decision-making as decision support system (DSS) and therefore viewed BI as a sub-field of DSS. Their major DSS sub-fields are personal decision support system(PDSS), group support system(GSS), negotiation support system(NSS), intelligent decision support system(IDSS), knowledge management-based decision support system(KMDSS), data warehousing, enterprise reporting and analysis system which includes executive information systems, business intelligence systems, and corporate performance management systems.

A similar standpoint was made by[29] who proposed 5 generic types of DSS: communication-driven, data-driven, document-driven, knowledge-driven, and model-driven. From among these types, all of business intelligence, executive information systems, and data warehousing and analysis systems fell under the data-driven DSS.

On the contrary, some researchers pointed out that terms like DSS and EIS are virtually disappearing and instead BI should be *the accepted term for analytical and strategic information systems* [25, 43]. Petrini & Pozzebon [25] ascribed the declining popularity of EIS or DSS to a lot of manual work needed to transform original data source into information insightful to executives or their narrow scope. Similarly, Watson [43] emphasized that "business intelligence" became more widely used in not only industry but also academia since Gartner analyst Howard Dresner first coined the BI term to describe all decision support applications in 1989 when the software industry was mired in DSS or EIS jargons.

In our opinion this dilemma of terminology was caused by an excessive expansion of a concept. For instance, Arnott & Pervan [3] defined DSS as an information system to support decision processes. In fact, supporting decision processes can be made through a number of approaches or a variety of constantly evolving technologies. It is our understanding that, once we are based upon each term's intrinsic characteristics, we will be able to compare these confusing terms intelligibly.

So Table 1 shows a result of the comparison among DSS, EIS, and BI. A conventional DSS is for a specific or, at most, a few decision-makers. And, it is most likely that the DSS employs features of decision-making models but, to a much less extent, features of extracting insightful information by massaging a bunch of raw data. One may also say

that as the DSS is close to a stand-alone type of system it has less dependence relationship with other existing systems.

In comparison, EIS and BI system are more information-focused. The only difference between these two is a matter of degrees, such as the number of users, data handling requirements, and dependence with other systems. In a word, BI system is more enterprise-level than EIS.

There exist two additional terms frequently cited in these systems: data warehousing and data mining. Data warehouse is a technology or a component of BI system used for reporting and data analysis [13]. On some occasions, the term *'data warehousing'* is used as a system or project in itself [46, 43]. In our understanding, the latter denotes a system or development project exploiting a set of data warehouse-related technologies.

Similarly, data mining is used also as a technique [10] or a system that chiefly employs data mining techniques [8]. In this paper, these two terms are used for either purpose, depending on the context.

Critical success factors of information systems

Critical success factor approach is a method to identify key elements that must be in existence or go right for an organization or project to achieve its goal. Since [32]'s first use in the definition of information needs of chief executives, the CSF approach has been used extensively in MIS field in order to inquire about key factors in system development project.

Table 1 – A comparison of DSS, EIS, and BI

	A conventional DSS	EIS	BI system
User	specific decision-maker	board of executive managers	the entire staff demanding business insights
Amount of information to handle	small	medium	large
Use of analysis models	most likely	not essential; likely to use basic financial models	not essential; likely to use specific models in a given domain
Dependence with other systems or IT infra	small	medium	large

Virtually all different types of information systems have been subjects for this inquiry. Pinto & Mantel [26], Fortune & White [16], and Nasir & Sahibuddin [27] employed the CSF approach to identify key factors for software projects. Key factors regarding ERP projects were identified by a number of researchers including Holland & Light [20], Al-Mashari et al. [2], and Ngai et al. [28]. In addition, the CSF approach was also applied to BI-related systems, such as DSS [14], EIS [27], BI [47], and Data Warehousing [46].

Such a wide variety of CSF studies, however, has led to an issue of interpretation about CSFs [16]. As each CSF study was made on different samples and dissimilar research settings, some CSF studies, of course, have generated different set of factors [41, 28]. Moreover, key factors may differ on different project size [27] or different country or geographical area [27,28]. Besides, such a difference may have been caused by obscurity [16]or granularity in factor definitions. For instance, a particular factor in one study might be *semantically* similar, though not identical, to a factor or a sub-factor of some factor in another study.

For this reason, some researchers have attempted to compare and synthesize the CSFs that were identified under different studies. Fortune & White [16] and Nasir & Sahibuddin [27] examined CSFs for software projects while Nah et al.[25] and Ngai et al. [28]reviewed CSF studies based on ERP projects. All of these studies have employed a systematic literature review.

Table 2 - Evaluation of the CSF-synthesizing studies

Study	Object	# of works	Synthesizing Scheme	Results
Nah et al. [2001]	ERP	10	x	11 factors
Ngai et al. [2008]	ERP	48	▲(used Nah et al.'s result)	18 factors
Fortune & White [2006]	Software project	63	0	27 factors
Nasir et al. [2011]	Software project	43	x	26 factors

An evaluation on these CSF-synthesizing studies was made as shown in Table 2. Each study was evaluated in terms of project types, number of works covered, use of synthesizing scheme, and factors synthesized. It should be noted that only Fortune & White's study has employed a synthesizing scheme for CSFs[16]. They used as the synthesizing scheme the Formal

System Model. The FSM enables us, by representing most core systems concepts of a 'purposeful entity', to understand more systematically how the entity works successfully [Bignell & Fortune, [5]. Bignell & Fortune [5] claimed that the FSM can be used to overcome difficulties in interpretation of factors found in various studies [Fortune & Peters, 1990] [16].

A scheme for synthesizing success factors

The more the project success factor studies are made, the less chance there appears to be a consensus of opinion among researchers on these factors [Wateridge, and Fortune & White, [41, 17]. This problem has led to the debut of CSF synthesizing studies, the ultimate objective of which was to construct a list of common CSFs. What is important in this effort is that a scheme is needed to cross-match the factors that were produced separately. Bignell & Fortune [16] Formal Systems Model is a good example [16, 17].

We here propose a general framework for synthesizing the individually generated critical success factors. The framework is largely built on the Social Capital Theory, which makes much of relationships among network members as a key resource for social action [1].

Nahapiet & Ghoshal [26] understood that differences in performance between firms may accrue from differences in their ability to create and exploit social capital. They also suggested that firms may utilize three different dimensions of social capital: structural, relational, and cognitive. The structural dimension of social capital refers to the overall relationship pattern of network as a whole, while the relational dimension represents the pattern of personal relationships among network members. And, resource providing shared representation and meaning within the network can be signified as the cognitive dimension.

Their insight that, in order to make a firm successful, management should reinforce an organizational capability to manage social capital was applied in IT management by[24]. He understood that delivering value through IT is mainly knowledge-based practice. Furthermore, he ascribed an organization's incapability to generate business value from IT investment to contemporary IT management practice that is symbolized as an island-like IT function. That is, although much part of the knowledge in IT management is located in non-IT functions, the IT department does not have an access or authority over this knowledge. To overcome the limits, he suggested that an organization-wide knowledge integration be made. Moreover, he presented, as examples, a set of organizational initiatives in each of the three domains of social capital.

The issue of system development is perhaps a little different from the normal IT management. Because the development of a system nearly always demands referring to a set of business or technical blueprints, we suggest that another dimension of knowledge or social capital be needed for managing a system development project. Such blueprints are usually named as architecture or enterprise architecture, which is defined as "the organizing logic for key business processes and IT capabilities (resources) reflecting the firm's operating model"[33].

Therefore, key factors for system development project can be organized in four dimension: structural, relational, cognitive, and architectural. Further, to cross-check CSFs, we propose a framework in which 13 key factors were identified, each belonging to one of the four dimensions.

Before taking that further, we have attempted to check the feasibility of this framework. It was assumed that an application test be taken to ensure if this framework may classify distinctively a particular set of CSFs. For this purpose, Ngai et al. [28] 's study was selected because it is the latest ERP CSF synthesizing study and its result was regarded as vastly comprehensive. Among their 18 CSFs, two ('national culture' and 'country-related function requirement') were excluded from our consideration because these two were meaningful only to the study dealing with a possibility of regional or national difference, which does not apply in our study.

Table 3 shows the result of cross-checking between the synthesizing framework and Ngai et al.'s list of CSFs for ERP. Be noted that these two sets of CSFs are matched one-to-one in the majority of cases. In this respect, our synthesizing framework was regarded as solid enough to be used for CSF cross-checking.

Table 3 – Cross-checking of the framework with ERP CSFs

The Synthesizing Framework		**Ngai et al.[2008] CSF**
Structural	Joint project team	ERP teamwork and composition
	Project leading by users	Project champion
	IT governance (Top Management/ Steering Comm.)	Top management support
Relational	Effective communication	Communication
	Joint(business-IT) performance management.	Monitoring and evaluation of performance
	Collaboration with external stakeholders	ERP vendor
Cognitive	Users' skills & competence	Organizational characteristics
	Educational programs	Change management culture and program
	Organizational change culture	Change management culture and program
Architectural	Data/information	Data management
	Systems/IT infra	Appropriate business and IT legacy systems
	Project management & development methodology	- ERP strategy and implementation methodology - Project management - Software development, testing, and troubleshooting
	Business goals & process	- Business plan/ vision/ goals/justification - Business process reengineering - Fit between ERP and business/process

Literature Analysis Methodology

The aim of our study is to answer the question of whether there is any difference in CSFs not just between BI systems and typical information systems but also between generally known BI systems and differently-titled BI systems such as DSS and EIS. In this section, we present our literature analysis methodology.

First, we need locate BI CSF literature. As our analysis requires the literature for a variety of BI-like systems, we include all of these terms in our literature search. A comprehensive search was made on Web of Science. The keywords was shaped like "(BI or DSS or EIS or DW or DM) and (Success Factor)". Their full names as well as their acronyms were used at the same time. After eliminating publications that are other than academic journal articles and were evaluated as 'non-CSF study' from authors' review of their abstract, we have located 14 journal articles including 3 for BI, 2 for DSS, 4 for EIS, 3 for DW, and 2 for DM, which were shown in Table 4.

Next, we need to identify CSF studies for typical information systems as a comparison target. Because there exist a slew of articles in this area, we decided to use a list of CSFs that had been already synthesized before. Two synthesizing studies for software projects were found such as Fortune & White [17] and Nasir & Sahibuddin [27]. Of the two, Nasir & Sahibuddin [27]is a later one and, to produce a list of most common CSFs, further cross-checked their results with those of Fortune & White [17]. This final list is going to be used as a comparison.

Table 4 – The list of BI CSF Studies

	area	**Title**	**Author**	**Year**	**Journal**
1	BI	Success Factors for Business Intelligence and Data Warehousing Maturity and Competitive Advantage	Gonzales	2014	International Journal of Information Management
2	BI	Business Intelligence Acceptance: The Prominence of Organizational Factors	Grubljesic & Jaklic	2011	BUSINESS INTELLIGENCE JOURNAL
3	BI	Critical Success Factors for Business Intelligence Systems	Yeoh & Koronios	2010	Journal of Computer Information Systems

4	DM	Critical Success Factors for Implementing CRM Using Data Mining	Ranjan & Bhatnagar	2008	Journal of Knowledge Management Practice
5	DM	Consolidation of Success Factors in Data Mining Projects	Sim	2014	GSTF Journal on Computing
6	DSS	Factors Influencing Success and Failure of Health Informatics Systems--A Pilot Delphi Study	Brender et al.	1998	Decision Support Systems
7	DSS	A Classification of Success Factors For Decision Support Systems	Finlay & Forghani	2013	Decision Support Systems
8	DW	An Empirical Investigation of the Factors Affecting Data Warehousing Success	Wixom & Watson	2001	MIS Quarterly
9	DW	Data Warehousing: A Framework and Survey of Current Practices	Watson & Haley	1997	Journal of Management Information Systems
10	DW	Critical Success Factors for Data Warehousing: A Classic Answer to A Modern Question	Kimpel & Morris	2013	Issues in Information Systems
11	EIS	Key Antecedents of Executive Information System Success: A Path Analytic Approach	Bajwa et al.	2010	European Journal of Scientific Research
12	EIS	EIS Success: Keys and Difficulties in Major Companies	Salmeron	2001	Decision Support Systems
13	EIS	Critical Success Factors Revisited: Success and Failure Cases of Information Systems for Senior Executives	Poon & Wagner	2015	Information Systems Management
14	EIS	The Keys to Executive Information System Success	Rainer & Watson	2012	International Journal of Enterprise Information Systems

Results and Implications

A set of CSFs for software projects were made by a number of scholars. Recently, Nasir & Sahibuddin [27] compared 43 articles from the years 1990 to 2010 and, as the result, compiled 26 critical successful factors. They further cross-checked with the result of another synthesizing study by Fortune & White [17] to finalize a set of common factors in both studies. Table 5 shows this list.

Table 5 – A final list of CSFs compiled through Nasir & Sahibuddin [2011]'s study

Number	Factor	Number	Factor
1	Clear objectives and goals	10	Up-to-date progress reporting
2	Realistic schedule	11	Effective monitoring and control
3	Effective project management skills/methodologies	12	Adequate resources
4	Support from top management	13	Good leadership
5	User/client involvement	14	Risk management
6	Effective communication/feedback	15	Complexity, project size, duration, number of orgs involved
7	Skilled and sufficient staffs	16	Effective change and configuration management
8	Familiarity with technology/development methodology	17	Good performance by vendors/contractors/ consultants
9	Appropriate development processes/methodologies	18	End-user literacy, knowledge and skills to use the system

To make a comparison among different sets of CSFs, we take 'a presence check' approach by which we only determine if a category in one list is present in the other list. With this approach, level of intensity or frequency is disregarded.

Main part of our analysis is shown in Table 6. The leftmost two columns corresponds to our synthesizing framework while on the right-hand side are the result of 14 BI and BI-like studies shown. The rightmost column indicates the result of a presence check with the final list of CSFs for software projects.

First, we review critical success factors of BI projects in a broad sense. We found that 'IT governance structure', 'Project management & development methodology', 'Data/information', 'Systems/IT infra', and 'Joint performance management' are the five most critical success factors for business intelligence projects. In comparison, 'Project leading by user', 'Organizational change culture', 'Collaboration with external stakeholders', and 'Educational programs' are factors of less importance. What 'Project leading by user' and 'Organizational change culture' were identified as the least important CSFs was a quite surprise. These two factors seem to be closed related with 'business-oriented approach'. Watson & Wixom [2007] identified, through an analysis of most successful BI cases, a set of facilitating conditions for BI success,

Table 6 – A Comparison of BI CSFs with IS CSFs

The Synthesizing Framework		area	BI			DM		DSS		DW			EIS				IS
		No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Structural	Joint project team			*	*					*	*	*	*			*	*
	Project leading by users		*		*										*	*	*
	IT governance (Top Management/ Steering Comm.)		*	*	*	*		*	*	*	*		*	*	*	*	*
Relational	Effective communication				*	*	*		*			*	*	*		*	*
	Joint (business-IT) performance management.		*			*	*	*	*		*	*	*		*	*	*
	Collaboration with external stakeholders				*		*	*	*				*				*
Cognitive	Users' skills & competence			*		*		*	*	*				*	*		*
	Educational programs			*	*			*	*		*		*				
	Organizational change culture			*				*							*	*	*
Architectural	Data/information		*	*	*	*	*		*		*	*		*	*	*	
	Systems/IT infra		*	*	*	*	*		*		*	*		*	*	*	
	Project management & development methodology		*	*	*	*		*	*	*	*	*		*	*	*	*
	Business goals & process				*	*			*		*		*	*	*	*	*

luding 'Senior management believes in and drives the use of BI', and 'The use of information and analytics is part of the organization's culture'. The present lower success rate of BI projects may result from the absence of business-oriented approach requiring user-driven project initiation and change management [Schiff, 2014][36]

In terms of knowledge areas, we can find out that factors belonging to cognitive area are currently evaluated as that of less importance. As many scholars emphasized the importance of BI capabilities [22,25] from this time forward firms ought to place more stress on capability building programs.

Second, BI CSFs are compared to those of general software projects. We found that, with BI systems, 'data/information' and 'Systems/IT infra' was counted as more important than typical information systems. It is quite understandable because BI systems needs to gather and transform data from a variety of data sources and, in this process, most probably need to connect with other information systems. A point of interest is the less importance of 'Collaboration with external stakeholders' factor. Whereas a considerable number of information system are bespoke software and are often developed by outside software developers or systems integrators, many of BI systems often tend to be implemented on BI tools. Determining which BI tools to buy is not easy[37]. An even bigger problem is that firms are "rushing into purchasing BI tools without defining the business problems you are trying to solve" [36]. Therefore, you should, from now on, be able to have a good relationship with and consult more frequently with external stakeholders including BI tool vendors.

Third, it is now to identify if there is any difference in CSFs between BI systems and some particular types of BI systems. When it comes to a difference with DSS, BI projects regard 'Data/information', 'Systems/IT infra", 'Joint project team', and 'Project leading by users' factors more importantly than a conventional DSS. The deviation may result from DSS characteristics such as more stand-alone type and less user-driven endeavor. And, greater importance was placed on 'Joint performance management' in DSS. It could be the case that, as most of DSS users are high-level decision makers or managers, they, by the roots' seem to be more results oriented. More emphasis on 'Collaboration with external stakeholders' in DSS could have to do with an almost indispensable use of decision models. In the process of model building or interpretation of model outcomes, one may need lots of outside experts' support or advice in a given domain.

Comparing to EIS CSFs, EIS projects are placing more emphasis on 'Joint performance management' and 'Effective communication'. The former can be explained identically with more goal-oriented users, as mentioned earlier in DSS. A plausible reason for the latter is that, as executives tend to be pressed for time and a heavy schedule, they may be definitely impatient with less-effective communication. In this sense, an effective communication would have been one of key success factors.

A comparison of BI CSFs with DM and DW CSFs is followed. We begin with DM. We found out that less emphasis was placed on all the factors in structural area. It indicates that DM projects appear to be less business-oriented and rather technique-focused. A point of interest is that 'Educational programs' factor was evaluated as that of less importance. It could be the case that, as most of data mining algorithms or techniques are very much complicated, it is almost impossible for the ordinary layman to grasp the essence of how the system really works even though a certain amount of training or education is offered. That is, education may not be a good help in DM projects. As for DW, DW has many similarities with BI, except in the case that 'Project leading by users' was less emphasized. In those days most DW projects were triggered by an emergence of the then new technology such as ETL or OLAP. So, it was quite a matter of course that BI project was all initiated by technical side, not business side.

Summary and Future Study

In the business world are many types of information systems in existence. The larger issue is that on some occasions, owing to the ebb and flow of new technology, a particular type gained popularity and suddenly disappeared from our view. Systems like BI is that kind. Currently the term DSS is not much used and the EIS term is seldom used. DW and DM are no longer used as a term of information system and just as a term of technique or technology.

Such rise and fall of information systems has sparked some scholarly interest. Whether is a set of

CSFs for BI systems similar to that of the other type? Whether is there a meaningful difference between BI CSFs and those of BI-like systems, the terms of which are no longer widely used? In order to answer these questions, this study has attempted a literature analysis on CSF studies. For this purpose, we first proposed a general framework for synthesizing the individually generated critical success factors and then conducted a presence check analysis on the existing CSF studies.

From a review of BI CSF studies, we identified that 'Organizational change culture', 'Collaboration with external stakeholders', and 'Educational programs' were treated less importantly. That is deemed as the absence of business-oriented approach and perhaps accounts for the lower success rate of present BI projects.

A comparison against CSFs of general software projects showed that 'data/information' and 'Systems/IT infra' was counted as more important than typical information systems. This may have stemmed from characteristics of BI systems in which a connection with other systems is an indispensable features in order to elicit business insights from a variety of data sources. On the other hand, we have understood that the less importance of 'Collaboration with external stakeholders' indicates firms currently not having a good relationship with BI tool vendors and therefore not affording to consult them on many matters.

And, EIS and DSS projects put more emphasis on factors that are much related to goal-oriented users like executives or high-level decision makers. A comparison against DM and DW indicated that most of these projects were initiated by people of technical side and therefore business-oriented or organization-wide factors were taken less importantly.

Results of this study are believed to make a contribution in theoretical as well as practical angel. Practically speaking, first, we provided BI practitioners with some helpful hints such as which critical factors to be paid more attention to from now on. Whereas most of existing BI CSF studies just highlighted the set of CSFs found through their own investigation, with no consideration of results of other studies, we were able to construct a common list of critical success factors. In this way, we hope that BI practitioners do not just conform to results of former studies but will be able to understand true characteristics of BI systems and thus discern a number of critical success factors, existent or to be discovered newly. For a theoretical standpoint, the general framework for synthesizing CSFs can be used to contrast a variety of individually conducted CSF studies each other. We believe that this way we would be able to construct a common body of knowledge (CBK) about critical success factors of IS.

For future work, we need to devise, for a CSF comparative study, a more elaborated analysis method other than a presence check. Further, we hope we will be able to come up with a building block for CBK of IS CSFs. This work is believed to relate strongly with the components of organization-wide knowledge for IT-initiatives which was the basis of the general synthesizing framework in this study.

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Impact of ICT to Minimize Earthquake Effect

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Abstract

In the world some countries lie under earthquake zones. Frequent occurring of earthquakes in such country has brought huge losses of life and property. The problem is how to reduce such losses. This study discusses how ICT tools help disaster management related to earthquake. This is a comparative study that aims to disclose the ICT practices followed in cross country situations. The design of the study is qualitative and as well as quantitative. The source of information is primary and secondary. The study presents specifics references of Nepal. Some sample cases available through secondary information are also analyzed for the references other countries that come under earthquake zone. Preliminary findings have indicated that there is significant impact of ICT in reducing risk of earthquake.

Keywords: earthquake, earthquake zone, preventive strategies

Introduction

Earthquakes are movement of ground occurring due to number of reasons such as tectonic ground motions, volcanisms, landslides, rock bursts, and man-made explosions. Of these causes, the naturally occurring—tectonic ground motions—is critical as it leads to disastrous events resulting in casualties in the form of ground failure, tsunamis, and fire hazard. There is continuous movement along the plate boundaries situated in earth's crust which are not smooth so friction causes to buildup stress and when these rocks break, there is release of energy that causes the movement of ground. Both quantitative and qualitative method exists for the measurement of earthquakes. Qualitative method for the measurement is based on the intensity of damage on structures while the quantitative measure is based on the instrument scale such as Richter scale. For engineering use, the seismic ground motions are measured using device called accelerometer which is a plot of ground-acceleration vs. total duration of earthquake. These data are called accelerograms or time-history record which is used in the analysis and design of structures.

Despite the fact that small earthquake break often and large earthquake break once every year, till date there has not been an accurate method of predicting earthquake. It is relatively young science that has advanced rapidly over the years, but accurate forecast is still not possible.

Objective of study

The objective of this study is describing the possible impact of earthquake and search for remedies to minimize its impact.

Review of literature

Nowadays, information and Communication Technology (ICT) has been the most used means for disaster mitigation as means of disseminating information [14]. ICT can help establish preparedness networks that link emergency operation centres, emergency broadcasting systems and frontline emergency responders or communities [15]. There are various communication tools available to communicate: Telephone, Voice mail, Mobile, Fax, SMS (Send messages), Satellite telephone mobile, Publications, CD-ROMs, Internet (WWW), Email, Mobile fax, Intranet, Portable email devices.

The network can be used for educating communities on disaster preparedness, get information about upcoming hazards, and to warn the public and authorities about the consequences of a disaster. All these are available in the developed countries. In developing countries these resource are scarce. Internet has not reached in all parts of the country. So people may not be made aware of earthquake. Internet communication is therefore improved rapidly among the experts, professionals, academia and the public about risk and risk mitigation [16] and discussions are being made how to make them reach to all the people of the world.

At the time of earthquake network connection might be damaged and internet, email and mobiles may not work. There may be necessity to use the communication from the less damaged neighbouring areas or not affected areas. There may be the option to increase capability and quality of the network so that there seems minimum damages. It is Japan where enough literature is available relating earthquake. It has experienced in 2011, the biggest earthquake on record hit Japan, when its infrastructure of communication channels were already suspended due to the damages by huge tsunami [1] so the plans were of no useful. In all 13 major cities land lines, mobiles, internet and power supply became dysfunctional. To restore landlines it took 7 to 45 days, cone; for mobile it took 3 to 20 days and for internet it took 2 days to 120 days. For power supply it took 3 to 80 days. The interviews with the victims revealed "electric power and connectivity were lost at exactly the most critical lifesaving phase. The interruption of communication and the loss of information system capabilities was a significant obstacle to the entire recovery process. People and organizations were deprived of data, records, and the processing capacity necessary to deal with an overwhelming situation. The negative effect was particularly noticeable at the municipal government level" [1].

A survey conducted by Japanese private company revealed shows that almost 60 per cent of migrant from dangerously affected place of earthquake were dissatisfied with the process of information management. Local government supported them in many alternative ways. There seems two effective ways: Disaster-proof channels include the fire brigade, police, satellite phones, message boards, cars and emergency alert systems. And another one is to restore the usual communication channel as soon as possible.

Method

The method adopted in the study has two sources of information: secondary data available in different literature and primary data from the observation of damages of Gorkha Earthquake 2015. And in-depth analysis is done based on researcher's own experience in the field and some interview with the people affected by the earthquake and experts working in this field.

Nepal as earthquake zones

Nepal is located in one of the most seismically active zones. Lying on top of the subduction zone where the Indian Tectonic plate moves under the Eurasian plate and lifting up the Himalayas in the process, there is an imminent threat of earthquake around every corner of the year. Nepal has experienced a long history of earthquakes. During the past 100 years, three great earthquakes have occurred along the Himalayan [4] . These include the 1905 Kangra Earthquake, the 1934 Bihar-Nepal Earthquake and

1950 Assam Earthquake. The 1934 AD earthquake produced strong shaking in Kathmandu Valley, and destroyed 20 percent and damaged 40 percent of the valley's building stock [10]. The recent 2015 Gorkha Earthquake brought devastations that amounted to casualties of 8686 deaths, affecting 35 out of 75 districts in the Western and Central Regions[12]. The recent high-intensity 2015 Gorkha Earthquake, had caused not only substantial death toll and huge economic losses, but also heavy damage to many public residential buildings.

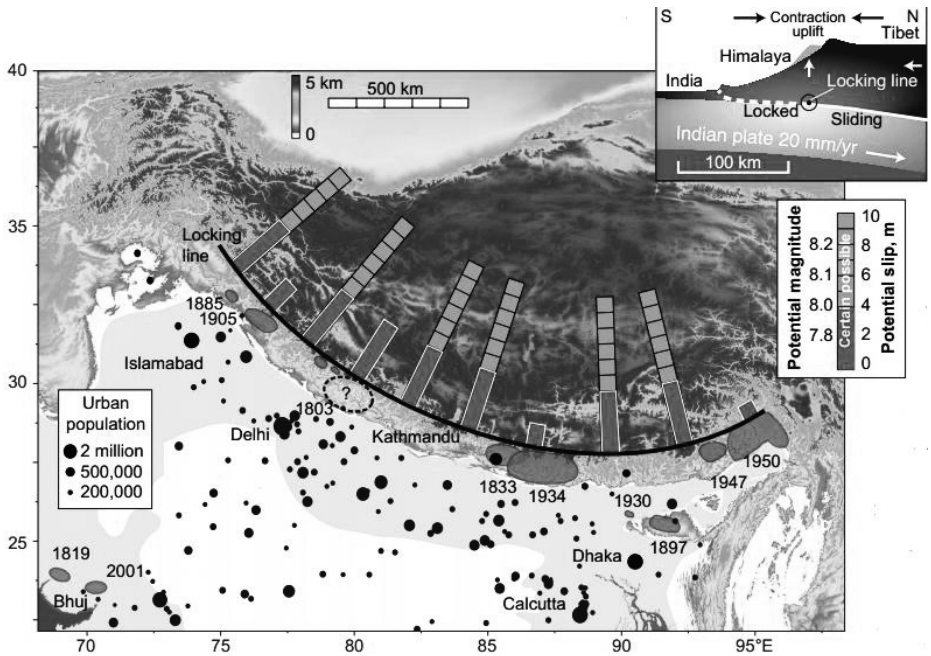
Table 1: major earthquake that occurred in Nepal

Date	time	lace	Fatalities
1255, 7 June		Kathmandu	2,200
1260		Sagarmatha	100
1344		Mechi	100
1408 August		Near Nepal-Tibet Border, Bagmati zone	2,500
1505, 6 June		Near Saldang, Karnali zone *see* 1505 Lo Mustang earthquake	6,000
1681 January		Northern Kosi zone	4,500
1767 July		Northern Bagmati zone	4,000
1833, 26 August		Kathmandu/Bihar	6,500
1869, 7 July		Kathmandu	750
1916, 28 August	06:39	Nepal/Tibet	3,500
1934, 15 January	08:43	Nepal/India/Tibet *see* 1934 Nepal–Bihar earthquake	8,519
1966, 27 June	10:41	Nepal/India border	80
1980, 29 July	14:58	Nepal/Pithoragarh	200
1988, 20 August	23:09	Kathmandu/Bihar *see* 1988 Nepal earthquake	1,091
2011, 18 September	06:29	Sikkim, India	111
2015, 25 April	11:56:26	Kathmandu/India/Tibet *see* April 2015 Nepal earthquake *and* list of 2015 aftershocks	8,922
2015, 12 May	12:38 IST	Nepal/China/India *see* May 2015 Nepal earthquake (one of the 2015 aftershocks)	213

Probability of an Earthquake that can break

Earthquake is a random event. Till date there hasn't been the discovery of a method that accurately determines when and where an earthquake will occur and how strong it will be. However, in a much generalized way methods have been established based on the recurrence interval of earthquake along individual segments of faults, the building up of strain within the rocks near faults, mapping of gaps in minor seismic activity along faults, and observations of minor changes in the physical properties of rocks [8].

Recurrence interval of past events is based on statistics and yields only probabilities of earthquake events happening in certain time intervals. This is based on the statistics of the size of earthquakes occurring at a particular time interval along the fault zone. Once there is enough data, predictive equations can be developed through regression analysis and the chance that an earthquake of particular size can be predicted based on the probability distribution of the data set. Likewise the information regarding the seismic gaps can also become useful in predicting earthquakes. Seismic gaps are places along large fault zones that have little or no seismic activity compared to adjacent parts of the same fault. Fig. 1 shows the histories of earthquake that have occurred in the Himalayan subduction zone represented by the extended arch.



It shows that earthquake of magnitude 7 or greater have occurred in 1803, 1833,1897,1905,1934, and 1950. At the central part of this extended arc there is higher probability of earthquake occurrence since the strain energy have not been released for a long period. It can be understood that since the areas of seismic gaps are not slipping, the energy build up process in these sections is continuous, until large amount of energy is released in the form of earthquakes.

Similarly the science of paleoseismicity approaches predicting earthquakes by combining archeology with geology and looks for ruins of ancient civilizations that show signs of earthquake damage. Isotopic or historical dating methods are then combined to determine the time of the ancient destructive earthquakes.

Series of damages it can bring to human and non-human life

Throughout the history earthquakes have led to devastating repercussions. Some of these include ground motions, ground breaks, mass wasting, liquefaction, tsunamis, fires and explosion, changes in ground water level, displacement of population etc. The amount of death and destruction is dependent upon the population density and quality of infrastructures (building, bridges) in that area.

The aftermath of an earthquake is always unnerving. Houses turn to rubbles, people get crumbled and the amount of losses it can bring is always dreadful and frightening to imagine. The recent Gorkha Earthquake brought non-human damages in the form of:

- Rock fall
- Landslides
- Cut and fill failure
- Land subsidence
- Liquefaction of lower strata of the soil

Role of information and communication in reducing it

The reduction of effects due to earthquake has to be a long term goal and should come through information and communication. Prevention and preparedness are the two approaches that come in the aid of achieving this goal. Preparedness relates with activities and measures taken in advance to ensure effective response to the impact of earthquake hazards. This covers issuance of timely and effective early warnings and the temporary evacuation of people and property from threatened location. This can be achieved by means of promoting readiness within local communities through public education, developing guidelines, procedures and action plans, professional training, capacity building and simulation exercises such as drop cover and hold and Shake Table demonstrations.

Likewise prevention strategies should come through implementation of building codes. The areas prone to high seismic risk in particular should have stricter building codes that regulate to design buildings which can withstand strong shaking and jolts with-

out the collapse of structures. On the other hand the detail seismic hazard potential of the region should be assessed and updated frequently. This should grasp the attention of policy makers and planners for better land use planning and urbanization. Information regarding seismic hazard potential of a region will help researcher to conduct detail seismic vulnerability assessment of buildings and come up with strategies to protect them.

How ICT play the role to minimize the risk of damage?

Countries lying in the seismic region are undoubtedly exposed to earthquake hazard but it doesn't mean that its occurrence will result in disaster. Hazards existing in this form cannot be avoided altogether but can be mitigated to minimize the losses. Earthquake Risk Reduction/Management initiates with the identification of potential sources of hazard, entities at risk and associated vulnerabilities due to earthquake hazard. ICT can play a pivotal role in achieving this goal by highlighting risk areas, vulnerabilities and potentially affected populations by producing geographically referenced analysis. A better example of this would be Geographical Information System (GIS) which is a system for capturing, and storing data of earth's surface on a computer which can be used by other applications to retrieve this information for quantifying and analyzing the data. Similarly the tool [7] which stands for risk assessment tools for diagnosis of urban areas against seismic disaster has been used in cross country scenarios to assess the seismic risk potential. It is a relatively simple tool that takes input in the form of the total area of the target region, total population and its distribution, ground condition, total numbers of lifeline, choice of earthquake scenario. Likewise it will display output of total seismic intensity, building damage, and lifeline damage. It has been implemented in Nepal by National Society for Earthquake Technology-Nepal (NSET) through Municipal Earthquake Risk Management Program (MERMP) and was successfully tested in three municipalities of Nepal in the year 2002-2003 [11].

Likewise there is an immense opportunity for machines to analyze data due to the availability of vast amount of data that is archived, stored and retrieved through cloud computing. Machine learning and Artificial Neuron Network (ANN) have become prevalent in the recent terms in the use of object identification, speech recognition, and weather forecasting. This concept has been extended by [2] for the earthquake magnitude prediction in northern Red Sea area by the use of ANN and the results were compared with other methods which showed that this approach gave better results when compared with other methods. Likewise Alimoradi & Beck [3] combined regression based on Gaussian process and genetic algorithms to generate earthquake accelerograms defined for a scenario level of earthquake. In fact genetic algorithms are nature inspired algorithms that use adaptation and simulation of different natural processes effective for computerized search and optimization. Recently four types of are implemented machine learning techniques for the prediction of earthquake of magnitude ≥ 5.5 occurring in the Hindukush Region that showed significant improvement in the earthquake prediction mechanism[5]. Likewise there used a combination of neural networks and fuzzy logics for the earthquake prediction in Iran[13, 9].

Conclusion

Earthquakes are natural phenomenon that is very difficult to predict and when they occur can cause significant amount of devastations depending upon the population density and the quality of infrastructures located in the area. Continuous effort has been spent by the scientific community for better earthquake forecast. Classical tools such as paleoseismicity and recurrence interval, to some extent, can avail meeting this objective. Since earthquake is a random event and highly nonlinear phenomenon the accurate modeling of this using the classical regression is not applicable but with the abundant data that is available at the moment which keeps on piling on the available database, if left to the machines by training them by means of ANN other techniques can improve the forecasting objective in the days to come.

Recommendations

Preparedness is the most important strategy to reduce loss from earthquake, so Tele-centres are the example of community-based access to ICT in low-income and rural areas which can provide a broad range of communication and information services to people at a cheap rate. ‘Internet cafés’ needs to be expanded in smaller cities too. Few other recommendation I may put here:

- Various experts for preparing information and designing the websites may join and work in cooperative manner.
- Web materials could be prepared in the way that it will reach to various groups of people based on their level of knowledge.
- Developed countries must help to developing countries to teach ICT technology and various means of communication must be made free.
- It is essential to resolving the shortcomings of the internet search capabilities.
- Expanding the internet café to smaller cities and rural areas.
- The curriculum and courses of basic level must include the techniques of reducing risk, it should not be the subject of learning in higher education only.

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Financial Analysis of Thai Banks: Effectiveness of Augmented Reality Visualization

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Abstract

The objective of the study is to examine the acceptance and usability of Augmented Reality (AR) visuals developed for industry analysis of Thai Banks and whether these visuals can outperform the table of numbers in representing financial accounting data. Convenient samples were used and the data were collected with self-assessed questionnaires from 109 users with minimum prior experiences with financial analyses.

The results from descriptive statistics indicates that despite having over 80% of respondents with little prior experience in analyzing financial performance of banking industry, the majority of them were able to correctly make prediction (96.4%), identify trend (82.6%) and compare banks' performance (70.6%). Their attitudes and perception towards Bank- AR visuals were above average. Although the overall usability score is average (53%), the respondents rated the Bank-AR visuals to be highly useful and had high intention to use them in the future.

Key words: Banking Industry Analysis, Data Visualization, Augmented Reality, Learning Usability

Introduction

One import part of an industry analysis is to analyze and compare financial performances of firms within their industry. This is because stakeholders of business tend to pay a great deal of attention to financial performance and ability to compete with firms in its own industry. Industry analysis is also an important element of a business plan so that management can form effective strategy to secure growth and success as well as correctly position the firm's products and services. With industry analysis, management can recognize opportunities and fend off threats. Stakeholders such as investors would be able to make better decision from their investment; lenders would be able to understand the liquidity position and solvency of the firm. Financial statements and financial ratios are typical sources of financial performance analyses.

A typical EXCEL spreadsheet with numbers and two-dimensional graphs are usually used to depict the comparative financial performances of firms in an industry. Nevertheless, the sheer numbers of matrices required to encompass the complexity of financial performance sometime make the depictions awkward. This is even more apparent in banking in-

dustry where its financial statements are unique and somewhat difficult to comprehend by inexperience users. Thus, the objective of this research is to develop simple and useful visuals that can engage and stimulate user's cognition through interactive visuals, the augmented reality visuals for banking industry or Bank-AR visuals in this case. It is hoped that users would be able to assess and understand financial data quicker as well as finding these innovative visuals useful in doing industry analysis.

It is indisputable that banking sector has an important role in economic development of any country, developing economies including. Commercial banks take many roles in developing country. For example, they help capital formation, provide loans to industry, and serve as facilitators in the movement of goods and services, financing trades, employment, consumer activities, and so on. In Thailand, commercial banks are highly regulated by the Bank of Thailand. If publicly listed, the Security Exchange Commission and the Stock Exchange of Thailand also dictate their compliances vigorously. Thus, naïve investors should learn and understand bank performance. Reading financial statements of banks can be quite challenging, the augmented reality visuals developed this research with actual banks data, called the **Bank-AR** hereafter, should be useful for minimal experienced people.

Financial statement analysis & industry analysis

To understand and evaluate a firm performance, analysts typically look at financial statements in order to see the financial position/ condition and revenues/ expenses of the company. Besides understanding a firm's condition, financial statement analysis includes the study of accounting ratios calculated from items in the statement of financial position and income statement. For example, asset utilization ratios, profitability ratios, leverage ratios, and liquidity ratios. Analysts would use the financial statements to determine the past, present, and future performance of a company. By comparing the financial statements between firms in the same industry, one would be able to have a sense of a company's financial health. However, if companies have different accounting methods, it would be difficult to compare their performance using only the numbers from financial statements. The situation magnifies when benchmarking with industry average.

For commercial banks, with the scale 1-5, CAMELS rating is used to evaluate institution's financial performance[14]. CAMELS comprise a composite evaluation based on six components: Capital Adequacy, Asset Quality, Management, Earnings, Liquidity, and Sensitivity to Market Risk. The framework uses items from financial statements as well as market data for evaluation. Including financial ratios as part of performance analysis is quite common, especially in industry analysis of listed firms in capital markets all over the world. Besides, performance (Kumbirai, Mabwe & Webb, Robert, 2010), financial ratios are used for other purposes, for example, to predict bankruptcy [1], operation efficiency determination [3], and competitiveness measures [5]. Thus, financial ratio depictions become the de facto standard in most corporates' annual reports that inevitably rely on the use of software tool like EXCEL.

Visual & cognitive learning with augmented reality

In an extensive review of literature behind visual analytics and computer and human perceptual and cognitive activities, Pohl, Smuc, & Mayr [11] identified five relevant theories, namely, Sense making Theory, Gestalt, Theory, Distributed Cognition, Graph Comprehension Theory, and Skill-rule-knowledge model. The authors pointed out the advantages and disadvantages of each theory and recommended that future research agenda should come up with comprehensive theory that is not a merger of all existing theories into one unified theory. Researchers should carefully merge only related theories into a coherent framework, extend or transfer certain theories, or create an entirely new but novel theory. In the present study that investigates the usability of Bank-AR visuals in simple industry analysis task, Graph Comprehension Theory is most applicable. However, the interactive nature of augmented reality has lent itself partially to the thrust of Distributed Cognition Theory.

Originated by Pinker [10], the Graph Comprehension's research has been flourishing. For example, Shah and Hoeffner reviewed graph comprehension literature from the standpoint of teaching graphical literacy to students[16]. They identified factors that affect graph comprehension including visual characteristics of a graph, a viewer's knowledge about graphs, and a viewer's expectations about the content of the data in a graph. With respect to visual

characteristics of a graph, Schonlau & Peters [15] examined the effect of display formats (e.g., graph types, tables of numbers) on users' comprehension. They compared pie charts, bar charts, 2D/ 3D display chart formats, and 3-way table and found them to be sensitive to the nature of tasks such as estimating absolute size of proportion, differences, equality and sums, and identifying trends.

Following the Distributed Cognition framework, DCog for short, by Edwin Hutchins, Liu el al elaborated how the theory is suitable for information visualization, especially in the area of visual analytics[8]. They pointed out the important of both internal and external representations that should be taken into consideration within a cognitive system of a person. Therefore, both individuals and the artifacts (representation media) being used, should be observed and propagated to fully understand how these two components interact with one another. Researchers then took on to separate directions, those focusing on visual exploration and analyzing the pattern of interactions [6, 12, & 13], analytic reasoning processes individual user characteristics[2, 4, & 20]

Usability together with User Experiences is another strand of research that appears to be the hybrid of many theories, Graph Comprehension and DCog Theory including. The Nielsen Norman Group (https://www.nngroup.com/) extensively trains, consults, and studies user experiences on different artifacts. They research how users interact with website usability, iPad_App usability, and usability/ user experiences on various components of E-commerce system (e.g., Homepage, Product-Pages, Shopping cart, customer services, transactional email, and so on). For any newly developed artifact, the study of its usability appears to be the first logical thing to do. Thus, the present research examines the usability of the Bank-AR visuals as a viable tool for industry analyses by inexperienced users. With the popularity of Pokemon Go, Augmented Reality (AR) technology has become visible to all walks of life. By integrating real image with virtual images, the technology allows a user to interact and experience real and virtual world simultaneously.

AR visualization enable users to rotate the images in 3D space. As compared to tables of numbers and graphs in EXCEL, previous studies on AR visuals found FinViz-AR visuals to be interesting, useful and acceptable. However, those AR visuals do not increase the learning performance nor do they reduce the cognitive load of the users. Users spent more time using AR visuals than 2D/ 3D graphs and tables. However, with easy to use AR visuals, novice users were able to assess financial performance of a firm similar to the experts. Nevertheless, experts spent more time analyzing the details when being presented with numbers in a spreadsheet table [18,19]. While FinViz-AR visuals represent the data from one firm at a time, the assessment task is likely to be less complicate than Bank-AR visuals. The design of Bank-AR visuals caters for industry analyses where the performance evaluation from several companies is visible together. Thus, the objective of the present study is to investigate whether novice users would be able to use the Bank-AR system for industry analysis and whether they find the visuals to be useful.

Research method

Data collection The sampling frame of study involves users with minimal or no experience. Thus, the second- year students from the Bachelor of Accountancy program in a large public university volunteered to take part in the study. They received class credit for participation. One hundred and nine usable questionnaires from 116 responses. Table 1 shows the participant's self-assessed prior experiences. Note that the majority of respondents did not have many prior experiences with financial performance analyses (81.6%) nor did they have clear analysis framework (84.3%). 89.9% had not compared financial data between firms before.

Table 1: Participants' self-assessed prior experiences

Prior Experience (N = 109)	Mean (SD)	Num (%) * Exp <=3
Expertise of financial Analysis	2.63 (0.94)	90 (81.6%)
Clear analysis framework	2.67 (0.85)	93 (84.3%)
Industry Analysis of financial data	2.14 (1.04)	98 (89.9%)
Familiarity of Thai banks	2.92 (0.86)	86 (78.9%)
Average prior experience score	2.58 (0.73)	

* Likert Scale: 5= a great deal; 4 = a lot; 3=moderate; 2=little; 1=very little

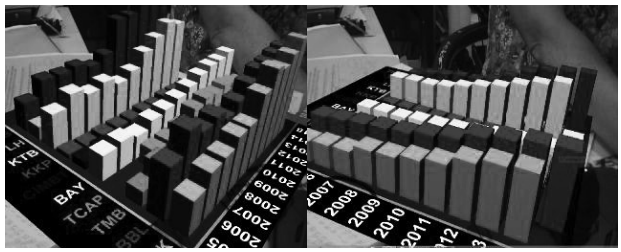

Figure 1: Bank-AR Visuals

Research instrument Time-series data from 2005 to 2015 of eleven publicly listed Thai banks are used to construct augmented reality visuals for basic financial performance analysis of banking industry (Figure 1).

The data includes four large-sized, three medium-, two small- and one very small banks. Selected data are included as the metrics or quantifiable measures of financial performance comparison among these banks (Table2).

Content	Abbreviation	Source
Loan and Investment Receivable	LOAN & INT RCV	BS
Total Assets	A	BS
Total Liabilities	L	BS
Total Equity	E	BS
Revenue	REV	PL
Net Revenue	NREV	PL
Depreciation and Amortization	DEP & AMT	PL
Income Tax Expense	TX	PL
Net Profit	NP	PL
Return on Asset	ROA	Ratio
Retuen on Equity	ROE	Ratio
Asset Turnover	ATO	Ratio
Net Fixed Asset Turnover	FATO	Ratio
Total Market Value	MV	MKT
Weighted Average Cost of Capital Economic Value Added	WACC EVA	MKT
Weighted Average Cost of Capital	WACC	MKT
Last Stock Price	P	MKT
Dividen Paid	DP	MKT
Current Market Capitalization	MC	MKT
Current Share Outstanding	SO	MKT
Free Cash Flow	FCF	CF
CF from Operating Activities	OPE	CF
CF from Invesetment Activities	IVF	CF
CF Flow from Financing Activities	FNF	CF

Table 2: Financial Measures/ Metrics Used for Augmented Reality Visuals

Source: BS = Balance Sheet; PL = Profit and Loss; Ratio = Financial Ratio; MKT = Capital Market Data; CF = Cash Flow

Online questionnaire using Google form was used to assess the study constructs. The questionnaire comprises four parts as follows:

Prior experience with financial data analysis of a bank: Self-assessment using 5 point Likert scale on four questions dealing with the subject's expertise in financial performance analysis, the extent of clarity of analysis framework being used, the experience of comparing financial data of firms in the same industry, and the familiarity with commercial bank business.

Financial performance analysis capability entails six questions that after looking at the Bank-AR visuals (Figure 1), the participant would use the data to predict, to identify, to differentiate, to estimate, to calculate, and to explain the performance of a bank or banks in question.

Cognition and perception toward the use of Bank-AR visual contains five questions using 5-point Likert scale. After exposing to the Bank-AR visuals, the participants give their views on how they are able to see the data organization and meanings. The extent of how they would have analyzed data differently, made error in the analysis, and increase or decrease amount of time required for analysis.

Usability of the Bank-AR visuals is adapted from the SUS-System Usability Scale [Brooke, 1996]. Ten SUS questions were translated into Thai. Additional two questions are included to address participant overall view towards Bank-AR usefulness and behavior intention to use Bank-AR visual in the future. All questions use 5-point Likert scale.

Results

Descriptive statistics of 109 usable responses are shown in Table 3. Over 75% of respondents were able to analyze financial data using the Bank-AR visuals correctly. In terms of the ability to analyze financial data, the respondents perceived Bank-AR to give clearer structure of data (C1. Mean (SD) = 3.64 (0.85)), allow them to better understand the meanings of data (C2. Mean (SD) = 3.41 (0.84)), and enable them to use different methods of analysis (C3. Mean (SD) = 3.69(0.72)). Nevertheless, they thought Bank-AR visuals might be somewhat prone to error (C4. Mean (SD) = 2.99(1.01)) and required similar amount of time as with using EXCEL (c5. Mean (SD) = 3.05(1.08)). Exploratory factor anal-

ysis (Varimax rotation) found two factors with the Eigen values of 1.734 and 1.451, accounting for cumulative sum of square 63.70%. With the loadings of 0.8 and above, the first factor, namely "data related' shows positive cognition and includes C1.Structure, C2.Meaning and the second factor, namely "effort-related" shows negative cognition and includes C3.Error-prone and C4.Time. Further analyses use the factor scores from these two factors.

Table 3: Descriptive Statistics

	Questions (N=109)	Statistics Number (%)
Ability to analyze financial data using Bank-AR		
	A1. Correctly predict	102 (96.4%)
	A2. Correctly compare	77 (70.6%)
	A3. Correctly seeing overall trend	90 (82.6%)
Cognition/ Perception toward Bank-AR visuals		Mean (SD)
	C1. Clear structure and organization of data	3.64 (0.85)
	C2. Understand meanings	3.41 (0.84)
	C3. Enable alternative data analysis method	3.69 (0.72)
	C4. Error Prone of data analysis	2.99 (1.01)
	C5. Time required as compared to EXCEL	3.05 (1.08)
SUS – System (Bank-AR) Usability Scale*		Mean (SD)
	S1. Would use frequently	2.21 (0.95)
	S2. Unnecessarily complex	2.17 (0.92)
	S3. Easy to use	2.35 (0.96)
	S4. Need technical experts	1.84 (1.29)
	S5. Well integrated functions	2.50 (0.70)
	S6. Inconsistency	1.89 (0.95)
	S7. Learn to use quickly	2.48 (0.97)
	S8. Cumbersome to use	1.86 (1.01)
	S9. Confident to use	2.13 (0.87)
	S10. Difficult to learn	1.82 (1.18)
SUS100 overall score *, **		53.0 (15.11)
Usefulness of Bank-AR for industry analysis		3.86 (0.83)
Intention to use Bank-AR		3.53 (0.88)

* Based on Brook (1996), the means score was calculated after reversal of negative measures and recoded them into the scale of 0-4 prior to multiplying the sum with 2.5 in order to get the calculating score of 100

** minimum score = 17.5; maximum score = 82.50

In terms of usability of the Bank-AR visuals, the highest score after transformation using Brooke's formula is S5.Well integrated functions (Mean (SD) = 2.50 (0.70)) and S7.Learn to use quickly (Mean SD) = 2.48 (0.97)). Two lowest measures S10.Difficult to learn and S4.Need technical experts are low from their negative usability standpoints. Note that the scores are right in the middle resulting to the Mean (SD) of the overall SUS100 to be 53.0 from 100 point. However, Bank-AR was rated relatively high for industry analysis (Mean (SD) = 3.86 (0.83)) with high intention to use in the future (Mean (SD) = 3.53 (0.88)).

The correlation matrix between variables (Table 4). As expected, the control variable, Average Prior Experience has no correlation with intention to use nor the two usability measures. It does have some relationship with the two factor scores of cognition/perception measures. Likewise, the two usability-measures correlate highly with one another. Intention to use positively relates to all data-related cognition/perception measure and negatively relates to effort-related factor. Intention to use also related to both usability measures, SUS100 and Usefulness (r=.629 and r=.538) at .000 level of significance.

Table 4: Pearson Correlation Coefficients of Variables

	Intention	1st Factor	2nd Factor	SUS100	Usefulness	Avg Prior Exp
Intention	1					
1st Factor Data-related	.427***	1				
2nd Factor Effort-related	-.271**	.000	1			
SUS100	.629***	.597***	-.398***	1		
Usefulness	.538***	.291***	-.165*	.395***	1	
Average Prior Experience	.076	.249**	.212*	-.002	-.006	1

*** p<=.001, ** p<=.01, *p<=.05

The correlations are high indicating possible multi-collinearity of variables. Although the multiple regression analysis (result not included here) between Intention to Use and all dependent variables shown in Table 4 yield 48% of Adjusted R Square with F-statistics = 20.935 (p=.000), the Tolerance, Variance Inflation Factor (VIF) and Durbin-Watson statistics were marginal. Only two Beta coefficients are statistically significant, SUS100 (t=4.381, p=.000) and Usefulness (t=4.496, p=.000). Table 5 shows simple regression models. The results confirm that each independent variable contributes to Intention to use Bank-AR. Except for the 2nd Factor-Effort related that has negative value, the more

the respondents rated the data-related cognition/perception and the more usability and usefulness, the greater Intention to use Bank-AR. Control variable uses Average Prior Experience, which does not contribute to the variance explained in Intention to use Bank-AR visuals.

Table 5: Simple Regression Models of the Intention to Use Bank-AR Visuals with Avg. Prior Exp as control variable

Independent variables	Std. Coef. Beta t-value (Sig.)	Std Coef. Beta of Avg. Prior Exp t-value (Sig.)	Durbin-Watson	Adjusted-R Square % (Std Err)	F-statistics (Sig)
1st Factor-Data related	.435 4.803 (.000)	-.033 -.359 (.720)	1.756	16.8% (.810)	11.907 (.000)
2nd Factor-Effort related	-.301 -3.180 (.002)	.140 1.476 (.143)	1.680	7.5% (.854)	5.391 (.006)
SUS100	.629 8.379 (.000)	.077 1.022 (.309)	1.745	39.1% (.693)	35.609 (.000)
Usefulness	.539 6.608 (.000)	.079 .971 (.334)	1.590	28.3% (.752)	22.266 (.000)

Discussion and conclusion

Bank-AR visuals were used as alternative visualization for simple industry analysis which allow comparisons between companies' financial performance, especially those in the financial statements and publicly available in the website of the Stock Exchange of Thailand. Time series data were used in the development of Bank-AR visuals. The visuals were designed to be easy to use for novice users as in the case of the present study.

The results show that AR technology is still quite new for this group of respondents, despite their awareness of its existence through popular mobile games like Pokemon Go widely played by similar group of respondents. Nevertheless, the complexity and amalgamation of accounting and external market data affect the design of visuals to provide as less amount of inks a possible but still provide maximum data for analyses. Thus, no number is depicted on the consecutive bar graphs. In some cases, there is a guide bar to help the comparison (Figure 1). This turns out to be the limitation as indicated by some respondents. Bank-AR users want to be able to see detailed graphs with numbers because they would feel more confident in the assessment of financial performance. Besides the need for numbers, the respondents would like to have EXCEL sheets as a backup. The familiarity and de facto visuals of spreadsheet used in business make it difficult for a novice user to embrace any other form of presentation wholeheartedly.

Similar to the results found in previous studies, respondents found Bank-AR visuals to be acceptable, useful, and they intend to use the visuals in the future Tanlamai et al ([19, 20]. There was no data collected from industry analysis experts in the present study. Thus, future research using Bank-AR should recruit experts to assess its practicality and applicability for analyzing industry financial performance data.

Besides user reports with questionnaire, future studies should consider additional usability evaluation methods are Cognitive walkthrough, Heuristic evaluation, usability testing through laboratory observation [9]. Future research should also devise a more sophisticated set of tasks for research subjects to perform so that the Bank-AR can reach its potential as a practical, financial visual analytical tool to do industry analyses and even to as a teaching graphical literacy mechanism to students.

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Preliminary Study on How to Manage People at Sharing Economy Organizations

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Abstract

Ride-sharing companies in Indonesia have transformed the choice of passengers to have a better option to ride a much cheaper and convenient trip, as well as the nature of how people work. This paper is a preliminary study with the objective to explore how ride-sharing companies in Indonesia manage their drivers to perform a high-quality service. Questionnaires will be distributed to people who have used ride-sharing, and content analysis will be utilized to explore the open-ended questions regarding the pleasant and unpleasant experiences in using ride-sharing service. An in-depth interview with top and middle management will be done to discover what the strategies to manage their drivers are to satisfy the customers. The findings of this study will be used as a reference for making policies and human resources programs specifically hiring and rewarding.

Keywords: Ride-Sharing Company, Quality Service, Independent Contractors, Human Resources Management

Introduction

Sharing economy platforms have become exceptionally popular in the last few years, and have changed the way in which people commute, travel, and doing many other activities [18]. It allows individuals and groups to make money from underused assets in which physical assets are shared as services [4].

Sharing economy business models are hosted through digital platforms that enable a more precise, real-time measurement of space capacity and the ability to dynamically connect this capacity with those who need it [4]. What ultimately keep this economy spinning—and growing—is not only the internet [15] via the use of smartphones but also trust and a sense of community [4].

Moreover, these sharing-based services offer better pricing, more convenient access, and more choice in the marketplace [4]. In another word, consumers are more interested in affordability and convenience than they are in building social relationships with providers or other consumers [4].

This condition means a shift to mobile, miniature, and wireless models of communication, computing, and transacting [8]. With this condition, companies now face unprecedented organizational challenges in adapting their human resources programs and organizational practices to the fast-moving business environment [8]. Sharing economy platforms are changing the nature of how people work [4].

For some people, this situation is regarded as a benefit. The most attracted benefit is flexible work hours [4; 22] because it enables workers to earn wages on their own time and terms [4] and can receive as much as they work [5]. Moreover, employees can set their working hours and have total work-life balance, and still be able to pay the bills [24]. Additionally, they are probably interested in better jobs and for economic reasons being part-time workers [23]. It also helps them offset the effects of the economic recession [23]. By generating new forms of informal employment, there is no need for employers to hire permanent workers [4].

However, some people perceive this model is an exploitation of workers [4]. Most of them consider the flexibility of hours appears to be more of a promise than reality [24] because when the job is no longer 9-to-5, it is hard to keep a work-life balance [21]. For employers, it is hard to offer a consistently high-quality experience with a workforce that is temporary [2].

There are numerous shared economy companies, from transportation, hospitality, e-commerce, Internet infrastructure, enterprise solution, and etcetera. However, the most popular discussion is Uber which has a lot of controversies in many countries around the world because it creates an enormous competitive risk for local taxi firms.

Aside from being perceived as a violation of public transport regulation, there are several reports about Uber drivers' misbehaviors in the U.S., China, India, and Pakistan. For example, the drivers performed various instances of unprofessional manners by canceling trips all the time pursuing to get cancellation fee from passenger [16] or not picking up passenger after accepting a booking [12]. Moreover, there have been cases of raping and kidnapping [20], sexual harassment of a female passenger [10; 17], and some drivers calling female riders [26]. Additionally, drivers were reported behaving rudely, doing molestation [10] and robbery, threatening passenger to break a passenger's legs [7; 10] striking and killing a passenger [14].

Require

Responding to these drivers' misbehaviors, Uber claims that every driver is thoroughly screened through a rigorous process they have developed by constantly using standards requirements [25]. Uber obliges that all drivers must have the following criteria to be Uber driver membership: (1) National identity card, driving license, car registration; (2) a police verification certificate; and (3) a social referral character certificate; referral from a non-blood relative which should be validated and stamped by the government [7; 19]. The detailed requirements vary depending on what local governments allow, but within each city they operate, they aim to go above and beyond local requirements to ensure passengers' comfort and security [25]. But how come this rigorous process of a background check cannot stop the numerous misbehavior cases in several countries?

Misbehavior of drivers might have something to do with the working status of the drivers. Uber offers drivers to join as independent contractors or entrepreneurs, rather than employees [5; 14; 25]. With this status, they can work for themselves and free to take orders whenever they want [5; 25]. This working status could protect Uber from liability [14]. But the company's terms and conditions could be trumped in court if it has shown that Uber exercises a certain amount of control over its drivers and they are akin to employees. Such control factors include the ability to hire and fire drivers, decide where their services are performed, or provide them with specialized equipment, along with other considerations Uber has. [14].

However, some countries implement different status. For example, in Pakistan due to the availability of cheap unskilled labors, owner-driver model took over [26]. These drivers were mostly illiterate, did not know the directions and how to use apps and smartphones, and rude. Since these drivers did not own their cars and had no incentive to provide good service because they were on a fixed salary, they started cheating their customers and being rude and harassing customers [26]. Although drivers have taken a mandatory anti-sexual harassment seminar

[19], sexual harassments still exist.

It means that doing a background check on a driver or giving a mandatory training is not enough. Working status, on the other hand, gives a more significant effect on the drivers' misbehaviors. Being independent contractors of Uber, part-time/full-time of car's owners or owner-driver relationship model matters so much on the way drivers deliver their services because it affects the incentive they will bring home. Background checking, mandatory training, and working status are part of human resources programs on how to handle thousand of drivers. Many drivers mean a more complicated process.

With these circumstances, an analysis in Indonesian context will be done because there are three famous ride-sharing companies in Indonesia, namely Uber (America), Grab (Malaysia), and Go-Jek (Indonesia). Therefore, the objective of this study is to explore how ride-sharing companies in Indonesia manage their drivers to perform a high-quality service.

Literature review

This section will talk about ride-sharing companies in Indonesia and the role of human resources management in startups.

Ride-Sharing companies in Indonesia

Indonesia has become a very prospective market for transportation application providers after Go-Jek started its startup in 2010. Today, there are three ride-sharing companies which have transformed the choice of passengers to have a better option to ride a much cheaper and convenient trip. They are Uber, Grab, and Go-Jek.

Uber is a US-based company which started its business in 2009 and has spread in over 400 cities and 65 countries around the world. Uber entered Indonesia, specifically Jakarta, on August 2014. Grab is a Malaysian-based company which started in 2012 and has grown to become Southeast Asia's largest taxi-booking mobile application. Grab is the first to enter Indonesian market on June 2014, two months before Uber.

Go-Jek was founded in Indonesia since 2010 as hailing motorbike taxi but has just started to take off in 2015 after it introduced a mobile booking app. Today, Go-Jek has also spread in major cities in Indonesia and India and has expanded its service to cover not only personal transportation (motorcycle and car) but also parcel and food delivery, as well as on-demand-shopping. These three ride-sharing companies have a tight competition by giving a lot of promotion to attract consumers to use their services.

There are three challenges in one of the three ride-sharing companies in Indonesia (Go-Jek). First, management has not yet treated driver as partners especially in the involvement of changing tariffs decision. Second, there is too fast recruiting many drivers which create competition culture, rather than supporting each other (unlike Grab which hires by batch to make sure each batch of drivers get enough rides) [11]. Last, there is no formal representative body who can speak on behalf of the drivers to facilitate any conflict with the management [11].

The role of human resources management in startups

With the explosion of sharing economy workers, a majority of them want to be independent entrepreneurs, free of the strict scheduling requirements, close supervision, and other restrictions of traditional workplaces [15]. Experts observe that human resources (HR) departments in these new business models may have a limited scope because most of the work is automated [13]. More often than not, startup entrepreneurs go into business without a clear understanding of the value and importance of an HR department [3]. Most startups believe that HR only manages day-to-day activities and administrative duties that they, or other employees, could manage on their own. Additionally, hiring an HR specialist is not viewed as cost effective. It is hard for startups to justify hiring a non-revenue generating employee at an early stage [3].

HR plays a primary role in every business, especially startups because hiring and managing people is very much a human function in which you cannot automate that, but you can build lots of tools that help humans to do it faster and easier, such as applicant tracking system [6]. But this tool does not mean anything unless people are putting in the right information and making good decisions from it.

Antipathy toward HR can leave startups woefully unprepared to handle classic workforce challenges, such as rapid growth or harassment (situations recently faced by Twitter and Github, respectively) [6]. But aside from poorly handled workforce crises, in most cases ignoring HR in the initial stage of startups may lead to lower rates of success [3; 9] because refusing to take HR seriously is one of the top 10 ways to damage a tech startup [6]. Moreover, according to a study of Stanford PEC done by Baron and Hannan and which took eight years, companies that consider HR were the least likely to fail and the fastest to go public [9].

There are no clear-cut answers as to when to add an in-house HR professional, but by the time companies hit about 50 employees, they need HR resources that extend beyond administrative duties [1]. The company does not yet have to hire a full-time HR professional because it has outsourced its administrative functions, but it does need senior-level advice on performance issues, compensation plans, and onsite management training.

Experienced HR professionals observe that 'sharing economy' is indeed a new business idea but at its core, there is no significant change in its HR workflows. Therefore, the fundamentals of HR guidelines will remain same [13].

Research method

Using purposive sample, questionnaires will be distributed via e-mail or social networking to people who have used ride-sharing such as Uber, Grab, or Go-Jek. Questionnaires will be divided into two sections, namely (1) demographic data, such as gender, age, education, job level and (2) ride-sharing experience which include frequency of using it in a week, level of satisfaction, and open-ended questions on how pleasant and unpleasant experiences they have when using ride-sharing services.

Aside from descriptive analysis on respondents' demographic, content analysis will be utilized to explore the open-ended questions regarding the pleasant and unpleasant experiences in using ride-sharing service. Written responses about the experiences will be analyzed by measuring the quantity of text associated with each category to find out the quality services delivered by the drivers. Additionally, to answer the objective of this study, in-depth interview with the top and middle management will be done to discover what the strategies to manage their drivers are to satisfy the customers.

Conclusion

This paper is a preliminary study which will explore how the three ride-sharing companies in Indonesia manage their drivers in delivering high-quality services to the customers. The findings of this study will be important to the development of human resources management programs in the ride-sharing companies in Indonesia. For example, how to recruit the drivers selectively, deliver quality service training programs periodically, and create attractive income-sharing for the drivers, which will be benefiting not only the drivers but also the companies.

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Applying Eye Tracking to Detect Health and Recovery Process

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Abstract

Eyes may be windows into the soul making them a significant body organ. Analyzing eyes performance is essential for effective functioning of human. Therefore, following their motion could help doctors to make quick and accurate diagnoses for disorders like Autism, schizophrenia, or attention deficit hyperactivity disorder. In this paper, a process for diagnosis, treatment and control of Autism disorder using eye tracking is proposed and consider a group of Autism children for experience. The aim of this study is to develop a structured identification of basics of Autism being used in preventing this disorder. Thus, image processing is employed to discover the eye tracking influences in detecting and control of Autism.The results highlight the potential of gaze gestures for Autism spectrum disorder (ASD) being useful for recovery process.

Keywords: Eye tracking; Image processing; Autism spectrum disorder (ASD); Recovery process

Introduction

Eye tracking is the process of measuring either the point of gaze (where one is looking) or movement of an eye relative to the head. Irregularities in how the eyes track a moving object reflect defects in the neural circuitry of the brain and appear to correspond with particular types of mental disorders. Autism patients suffer from social and language deficits tend to look more at the shapes. *Pellicano et al* examined whether adaptive mechanisms for coding gaze direction are atypical in children diagnosed with an autism spectrum condition [1]. People with ASD had a stronger image center regardless of object distribution, reduced saliency for faces and for locations indicated by social gaze, and yet a general increase in pixel-level saliency at the expense of semantic-level saliency(Wang *et al*., 2015)[2]. Non-invasive eye-tracking technology was used to quantify the amount of time spent looking at another person's face during face-to-face communication in children with ASD, age and IQ-matched neuro typical children (TerjeFalck-Ytter, 2015)[3]. Toddlers with ASD who strongly preferred geometric

images had 1) worse cognitive, language, and social skills relative to toddlers with ASD who strongly preferred social images and 2) fewer saccades when viewing geometric images (Pierce *et al*., 2016)[4]. Eye tracking also used to identify the role of vision during real world tasks in older adults and people with Parkinson's disease (Stuart.*et al*., 2016)[5]. Some researchers discovered breakdowns of eye movement control toward smoking cues in young adult light smokers (DiGirolamo *et al*., 2016)[6].

Some children with ASD have high verbal competency, whereas others may not speak at all; some excel in response to treatment, whereas others do not (Rogers & Vismara, 2008; Bacon *et al*, 2014)[7,8]. Complicating ASD further is the fact that symptom onset is quite variable some toddlers may show signs at or even before the first birthday, whereas others may not show signs until the second birthday or later (Ozonoff *et al*, 2011)[9]. In general, toddlers with ASD fail to attend to social attention cues (Naber *et al*, 2008)[10] or may display "sticky attention" (Sacrey *et al*, 2013)[11]. Autistic children engage less in direct eye-to-eye contact(Sigman, *et al*., 1986)[12] and tend not to monitor the target of another person's gaze in social contexts(Leekam, *et al.*, 1998)[13]. However, people with ASD seem to have similar attention effects for animate objects, as do controls when measured with a change detection task(New *et al*., 2010)[14].

The current study investigated earlier researches to identify biomarkers of mental disorders and family, community, climate … can effect on the mental disorders specially autism.

Statement of the problem

Since the field of health scope, treatment and private health issue is always one of the main concerns, the early diagnosis of diseases and their treatment is very noticeable and important. Nowadays the doctors don't use just the clinical checkup, but they use the modern tools and technologies too, so they can diagnose the disease accuracy.

Because of the enormous potentials of information technology and the importance of health and early detection of diseases, systems are created to help doctors diagnose diseases and has increased the speed and accuracy, or even in some cases to reduce diagnostic error and saves the cost. Meanwhile diseases such as psychiatric disorders have a particular importance, because early detection makes treatment and monitoring recovery process more convenient, so it would be to make the best type of treatment for these diseases. The instruments are designed to achieve this make possible, eye tracking is one of these tools.

Human body and mind are connected and dependent on, the illness in each one affected other. Significant differences between patients such as children with autism than other children in communicate with others, so the children incapable to make any verbal or emotional relationship with rest and do not show the heed to presence of them. Also avoid eye contact with others, the act of making eye contact is extremely stressful for some people affected by autism, many of them also have unusual sensory responses, and may shy away from bright lights or may not notice if their clothes are rough and twisted. Medications do not treat the core symptoms of autism, such as problems with communication, but can reduce symptoms such as irritability. In this paper review effective and the impact factors such as environment, family, education and genetic to such diseases with eye movement process.

Method

Eye motility is a fragile function that is linked to the central nervous system. For this reason disorders and diseases that affect the cerebral cortex, the brainstem, or the cerebellum have a strong influence on eye movements (Vidal *et al*, 2011)[15]. In the case of autism, the lag time between a possible exposure and diagnosis makes the situation even more complex. Toddlers with autism are oblivious to the social information in the eyes, but don't actively avoid meeting another person's gaze, and they were also significantly less accurate a categorizing subtle deviations in gaze direction than typical children during the pre-adaptation phase. As the cost of the technology drops and accuracy of more common and practical tools improves, eye tracking may find wider use in

the clinical setting. Here, eye-tracking technology was used to identify children with Autism. Eye tracking is important for understanding the role of

vision during real-world tasks in Autism disease.

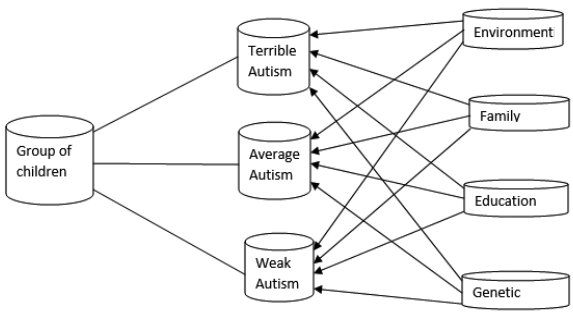


Figure 1- environment factor that effect autism

Participants

Twenty four high-functioning individuals with ASD (age range 2-12) were studied. The researchers tested an equal proportion of children from the three groups.8 children diagnosed with a terrible Autism, 8 children diagnosed average Autism and other diagnosed with weak Autism. All children had received an independent clinical diagnosis. No child had received an additional medical or neuro-developmental diagnosis.

Eye tracking

Eye tracking is especially useful for autism research because it can be used on young infants and children. Eye tracking is a technique whereby the position of the eye is used to determine gaze direction of a person at a given time and also the sequence in which there are moved (Poole & Ball, 2006)[16] the eye tracking method was used to measure children's fixations and number of saccades. In other hand, the goal of eye tracking is most often to estimate gaze direction. The rapid movement the eyes do simultaneously to change the line of sight is called a saccade (The word appears to have been coined in the 1880s by French ophthalmologist Émile Javal, who used a mirror on one side of a page to observe eye movement in silent reading, and found that it involves a succession of discontinuous individual movements.)

Saccade facts:

- can be triggered voluntarily or involuntarily
- both eyes move in the same direction
- the time to "plan" a saccade (latency) is task dependent and varies between 100-1000 ms
- the average duration of a saccade is 20-40 ms
- the duration of a saccade and its amplitude are linearly correlated, i.e. larger jumps produce longer durations
- the end point of a saccade cannot be changed when the eye is moving
- Saccades do not always have simple linear trajectories

Fixations (There are three categories of fixational eye movements: micro saccades, ocular drifts, and ocular micro tremor) are the stationary states of the eyes during which gaze is held upon a specific location in the visual scene(vidal *et al.* 2012)[17].

Fixation facts:

a fixation is composed of slower and minute movements (micro saccades, tremor and drift) that help the eye align with the target and avoid perceptual fading (fixational eye movements)

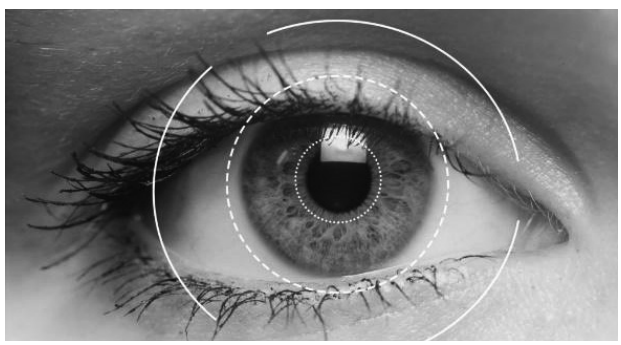
- the duration varies between 50-600 ms (however longer fixations have been reported)
- the minimum duration required for information intake depends on the task and stimulus

In a previous study, Rosenhall, Johansson and Gillberg (1988)[18] also showed that 55% of the autistic children they tested made hypo metric saccades, which means these saccades are too short to reach the target.

Two types of images are used in video eye tracking: images in visible spectrum and images in infrared spectrum (Hansen, 2005)[19]. There are a number of methods for measuring eye movement. The intelligence of the system, which finds specific details in the user's eyes and reflection patterns, and interprets the image. For track the eye movement in this study is used images in visible spectrum. The results of this method are dependent to ambient light. For poor light conditions it is very hard to detect the feature of the eye for tracking (Lupu & Ungureanu**,** 2013) [20]. There are a number of methods for measuring eye movement. The most popular variant uses video images from which the eye position is extracted.

Image processing for tracking the eyes

One of the methods available, the KLT tracker has used in this study. In computer vision, the Kanade–Lucas–Tomasi (KLT) feature tracker is an approach to feature extraction. It is proposed mainly for the purpose of dealing with the problem that traditional image registration techniques are generally costly. KLT makes use of spatial intensity information to direct the search for the position that yields the best match. It is faster than traditional techniques for examining far fewer potential matches between the images. KLT tracker involves finding the best features for tracking, pattern matching and corrects errors in target tracking has been improved. Goal is to align a template image $T(x)$ to an input image $I(x)$. x column vector containing image coordinates $[x, y]^T$. The $I(x)$ could be also a small sub window within an image. KLT tracker algorithm calculates the motion vector in two consecutive frames, for this purpose, the following formula is used:



$$\Delta p = H^{-1} \sum_x [\nabla I \frac{\partial W}{\partial p}]^T [T(x) - I(W(x;p))]$$

Figure 2- Eye tracking

-Warp I(Image) with W(x; p) = $\begin{bmatrix} x + b_1 \\ y + b_2 \end{bmatrix}$ that new point x Compared to the previous point b_1 to change and new point y Compared to the previous point b_2 to change. And p is Motion parameter. The warp W(x; p) may be linear but the pixels value are, in general, non-linear. In fact, they are essentially unrelated to x.

-Subtract I from T:

[T(x) – I (W(x; p))]

- Compute gradient:

∇I

- Evaluate the Jacobins:

$\frac{\partial W}{\partial p}$

- Compute steepest descent:

$\nabla I \frac{\partial W}{\partial p}$ W(x; p)

- Compute inverse hessian:

$$H^{-1} = \sum_x [\nabla I \frac{\partial W}{\partial p}]^T [\nabla I \frac{\partial W}{\partial p}]$$

The stability of the iteration is mainly influenced by the inverse of Hessian.

-Multiply steepest descend with error:

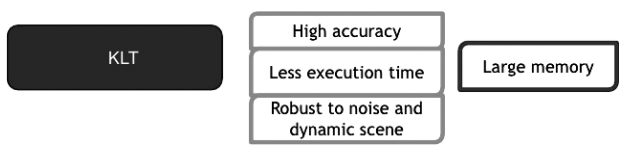
$$\sum_x [\nabla I \frac{\partial W}{\partial p}]^T [T(x) - I(W(x;p))]$$

-Compute:

Δp

- Update parameters:

$p \rightarrow p + \Delta p$



Experiment

Inflammatory bulb we use to start testing. Because it helps improve the situation of children with autism. Said eye tracking method was used to measure children's fixations and number of saccades.

Children were seated alone or in their parent's lap and asked them to see some pictures and videos, pay attention, but look however they want. The experimenter seated in chair. Eye tracking data were collected in a quiet room adjacent to the diagnostic clinic. Standard room lighting was used, and the room was sparse, with visual barriers used to reduce distraction. The whole session lasted approximately 10 min. Children's eye movements were measured frame-by-frame.

Based on clinical diagnoses these children have a language or global developmental delay, a wide array of conditions such as premature birth or prenatal drug exposure and unaffected children with siblings with ASD and Some delved into the role of the immune system and epigenetics, the study of factors that control gene activity. Others advanced animal models for the study of chemicals newly suspected of increasing autism risk.

Results

To be useful in the clinical setting, however, any new screening test must prove itself against simpler tools already in use. A thorough diagnosis of autism disorder takes time and depends on wide observation of children in their natural environments, which is precisely why a simple diagnostic tool is so appealing. The primary aims of this study were to establish the effect of Environmental factors such as, family, education and genetic. Not everyone with autism exhibits eye-movement deficits, but most of them have eye movement disorder. The results show that the relationship between early detection of autism and the age of children that effects on their comprehension abilities. It means those children who have been earlier diagnosed their disease, with treatment have better learning power. And those who play with some toys like trains, vehicle and etc. has less attention at the face compared to the other group. Genetics alone do not account for all instances of autism. Prenatal exposure to the chemicals acid has been linked to increased risk of autism. Some factors for example, appear to include such influences as parental age at conception, maternal nutrition, air pollution and infection during pregnancy and prematurity. So it is difficult, in most cases, to pinpoint any one environmental influence to the eye movements. In this case we can't say which factors more effect on eye movement. But what is clear is that genetic and drug use during pregnancy is most affected by the disease. Note, if doctors learn about how these influences affect brain development and eventually effect on eye movement, and how treatment and control of effect of environment factors the better they can help the children, adults and families who are affected by autism.

Discussion

To our knowledge, this study help doctors and families to treatment, control, or prevent some disease such as autism.

There are many different autism interventions across the globe. In any society, it is essential to understand and use best practices based on evidence-based research. Today, can involve behavioral treatments, medicines or both for autism. Many persons with autism have additional medical conditions such as sleep disturbance, seizures and gastrointestinal (GI) distress. Addressing these conditions can improve attention, learning and related behaviors specially eye contact.

So beyond enhancing clinical diagnosis, objective measures are needed that grade autism symptom severity and track symptom changes with treatment. In general, higher IQs are correlated with greater responsiveness to treatment and improved treatment outcomes.

Note, Early diagnosis and treatment helps young children with autism develop to their full potential. The primary goal of treatment is to improve the overall ability of the child to function. While there is no known cure for autism, there are treatment and education approaches that can address some of the challenges associated with the condition. Intervention can help to lessen disruptive behaviors, and education can teach self-help skills for greater independence. But just as there is no one symptom or behavior that identifies people with autism, there is no single treatment that will be effective for everyone on the spectrum**.** Individuals can use the positive aspects of their condition to their benefit, but treatment must begin as early as possible and focus on the individual's unique strengths, weaknesses and needs.

According to the National Institutes of Health (NIH), treatment for autism can include the following:

- Behavioral management therapy

- Cognitive behavior therapy
- Early intervention
- Educational and school-based therapies
- Joint attention therapy
- Medication treatment
- Nutritional therapy
- Occupational therapy
- Parent-mediated therapy
- Physical therapy
- Social skills training
- Speech-language therapy

People with autism have normal life expectancies. With early intervention and appropriate treatment, many autistic people can function productively and attain some degree of independence. Some people with autism spectrum disorders require lifelong assistance.

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Fault Diagnosis of Cutting Drill Machinery through Artificial Neural Networks of Sound Signals

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Abstract

Use of an appropriate fault diagnosis methods alerts in advance about failure of machinery. Sound signals of machines contain the dynamic information about their operating conditions. Acquiring sound signals are relatively low cost or/and affordable compared AE sensor. Hence, there is a need for studying the use of sound signal for fault diagnosis applications. This study develops an automatic machine fault diagnosis system that uses artificial neural networks. The sounds emitted by the operating machine, a cutting drill in this case, are obtained and analyzed for the different operating conditions. The machine conditions considered in this research are the undamaged drill and the defected drill with wear. The Time series data are used as the inputs of a neural network based classifier to separate normal and defective drill sound data. The results show that the proposed Time Domain and ANN method can be used for the sounds based automated diagnosis system.

Keywords:

Sound Signals, Machine Learning, Fault Diagnosis, Time Domain, Artificial Neural Network (ANN)

Introduction

Condition monitoring and diagnostic maintenance is gaining its importance in last few decades. Many industries are checking for highly durable and reliable machines that can be efficient and productive for long time. Major causes for failure in machine elements is due to improper design, material and manufacturing defects, installation errors etc. Failure is machinery specific and can be dangerous, so there is a need for scheduled maintenance. Various condition monitoring techniques widely used are vibration signals, sound signals, acoustic emissions, infrared thermography, wear debris analysis etc. Vibration and Acoustic Emission (AE) signals are widely used in condition monitoring of machines [1,2]. The fault detection is possible by comparing the signals of a machine running in normal and faulty conditions. However, data acquisition equipment used for vibration signals or AE signals analysis are costly. This prevents small scale industries and low cost equipment from using diagnostic tools on affordability ground. On the other hand, acquiring sound signals (microphones) are relatively low cost or/and affordable.

Tandon and Nakra [3] reported a detailed review of the different vibration and acoustic methods, such as sound measurements, vibration measurements, the shock pulse method and the acoustic emission technique, for fault diagnosis in rolling bearings. By just hearing the sound of a machine during its running, an experienced operator can even identify and locate some defined faults in the machine. This shows that the sound signals are strong indicators of the condition of the machine. Compared with vibrations, sounds can be collected easily by any operator who wants to build a diagnosis system, while the sensors that can capture vibrations of the machines are, in practice, difficult to find. That makes the sound-based analysis cheaper and simpler to set up while the vibration-based analysis can be expensive and a more complicated task. Processing the sounds can help to reliably identify the machine faults [4].

In the past, many studies have been based on the traditional methods of establishing a mathematical model, analyzing a variety of parameters and then judging the operating conditions of the machine [5-7]. However, the complexity of the real world machine system and the obvious existence of nonlinear factors such as unwanted noises that can corrupt the used signal make the mathematical models based approaches very difficult to handle and not efficient in terms of accuracy.

Machine learning technique is widely used now-a-days because from large sets of data, conclusions can be drawn in an effective manner. [8-10]. Support Vector Machines (SVM), which forms the advanced method of identification and classification of data based on experience rather than facts have been used as classifiers in the fault diagnosis of machines [11,12]. Artificial Neural Networks (ANN) have shown an impressive learning and memory capability. They have been widely used for automatic detection of faults in different ways and in other pattern recognition problems [13-15]. The ANN is non-linear model of solving problem. Artificial Neural Network model can easily give origination and severity of faults. The dynamic systems exhibit quasi-periodic, chaotic signals that contains valuable parameter information can be classified efficiently by ANN. That is the main reason why we have chosen to apply them as a classifier for our fault diagnosis system. In this research, sound data are collected from undamaged and defected drills. The sound signals analysis involving microphone can be easily fitted at any angle and at any place of the machine. We use time series data, then are fed to the neural network in order to perform the classification task. The methodology of the present study is given in the form of flow chart in Figure 1.

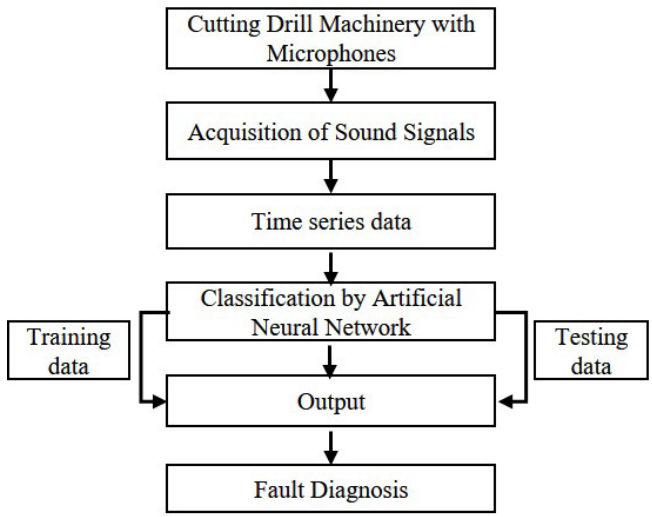
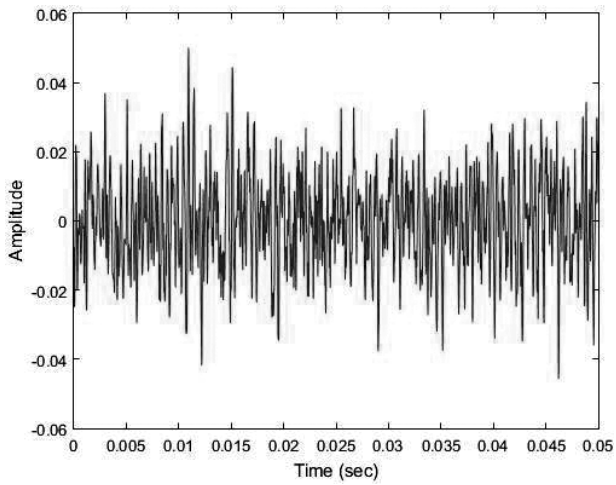


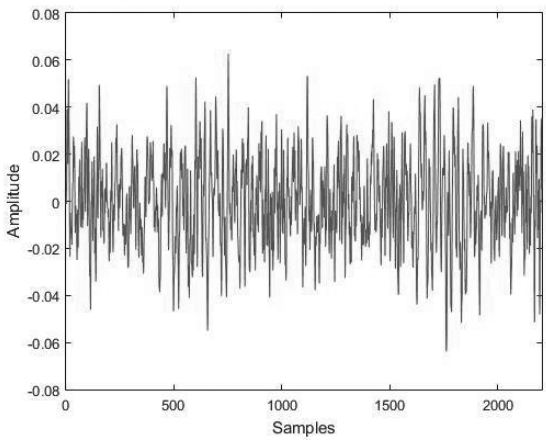
Figure 1 - Flow chart representation of fault diagnosis procedure.

Methods

Generally Machine learning based approaches mainly consist of two steps: the feature extraction process and the classification task. In the study, feature extraction is omitted and time series data is used as input for pattern classification. Therefore, the original data having a large vector size is cut to 0.05 seconds to reduce the size. Figure 2 shows an example of sound data in time domain collected during the experiments. The number of samples that were reduced in size was fully used to classify the patters without feature extraction. Next, we will discuss about some of the widely used pattern classification methods.



(a)



(b)

Figure 2 - An example of sound data collected during the experiments. (a) 50ms signal, (b) vector of size 2205.

Classification

Classification is the process of separating the dataset into different classes, or different instances. If the data are linearly separable (Figure 3), a simple line that can separate the instances can be easily found. Support Vector Machine (SVM) can be used for this purpose. SVM can also separate nonlinear dataset as it was demonstrated here [11,12]. But, we have chosen ANN for their capability of separating any nonlinear dataset that can exist [13-15].

Linear vs. Non-linear

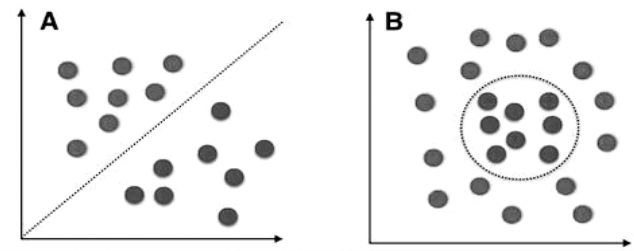


Figure 3 - Linearly separable and non-linearly separable dataset examples.

Artificial Neural Network

Artificial Neural Network (ANN) is a simulated model as that of working of a neural network of a human brain. ANN is an interconnected group of artificial neurons. These neurons use a mathematical or computational model for information processing. The neural network acquires the ability to generalize based on the training data and, if the training data contains all the characteristics, all the meaningful information possible of the processed sounds or vibrations, the network can predict outcomes for new, previously unseen data sound or vibrations. Figure 4 below shows the structure of an artificial neuron.

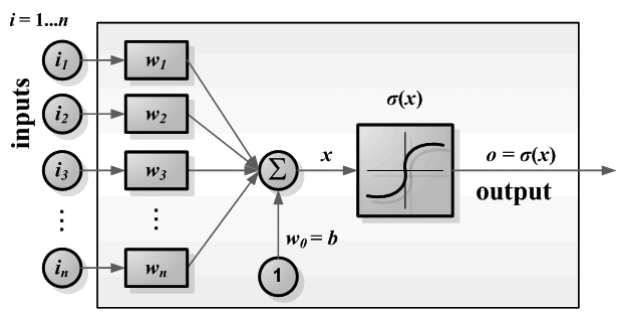


Figure 4. - Artificial neuron.

The artificial neuron (further on, referred to as a neuron) multiplies the inputs with the corresponding weights, then, it sums up the products and compares the sum with the threshold. The process is carried out through the (x) threshold function, the activity of which can be shown in the following equation:

$$\sigma(x) = \sigma(\sum_{i=1}^{n} w_i i_i - b \cdot 1) \qquad (1)$$

$$\sigma(x) = 1/(1 + e^{-x}) = \tanh(x) \qquad (2)$$

The most commonly used Eq. 2 is a sigmoid function. The Figure 5 below shows a graphic presentation of the (x) threshold function, where a sigmoid function is shifted left or right by the parameter b, and where the parameter N is responsible for its inclination.

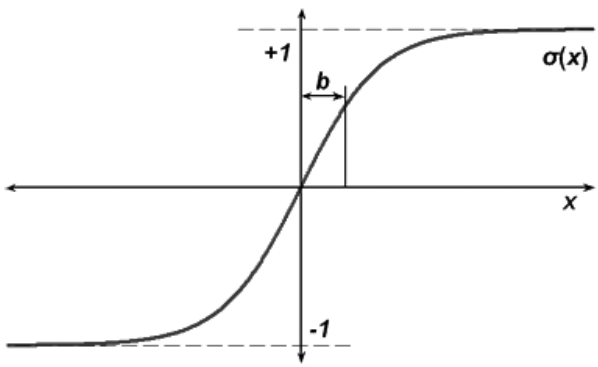


Figure 5 - Sigmoid function.

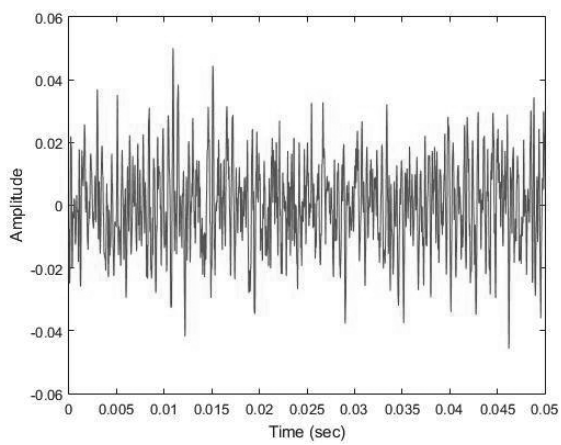
Experiment

We want to detect defected drill by analyzing the sounds emitted by it during its operating time. We have collected data sounds from an undamaged and a damaged drill using a microphone. Figure 6 shows the actual working environment of a die-casting company for obtaining sound data. It also shows the tools used for the experiment. We put the undamaged drill in the cutting machine then we've recorded the sounds for one minute and half. The, we take out the undamaged drill, replace it by the damaged one. We've recorded the sounds from both the undamaged drill and the damaged one. Sound being a nonstationary data, we've segmented the recorded sound into many parts to construct our dataset for the pattern classification. The sampling frequency used was 44100 Hz. The signal length 50 ms (0.05 s). We've created a dataset of 1038 data sounds, 496 from the "good" drill and 542 data from the damaged drill. Some samples are shown in Figure 7.

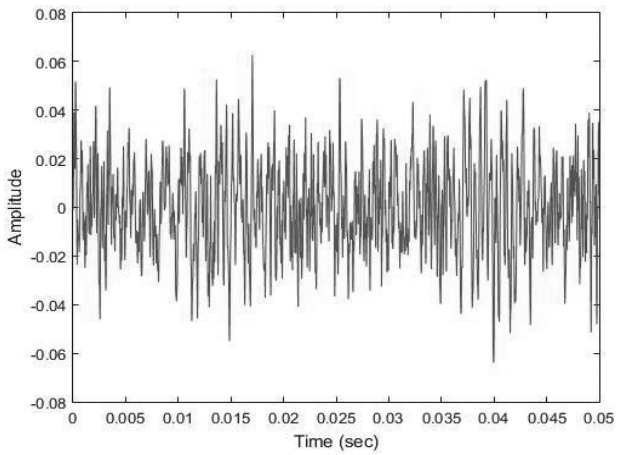
(a)

(b) (c)

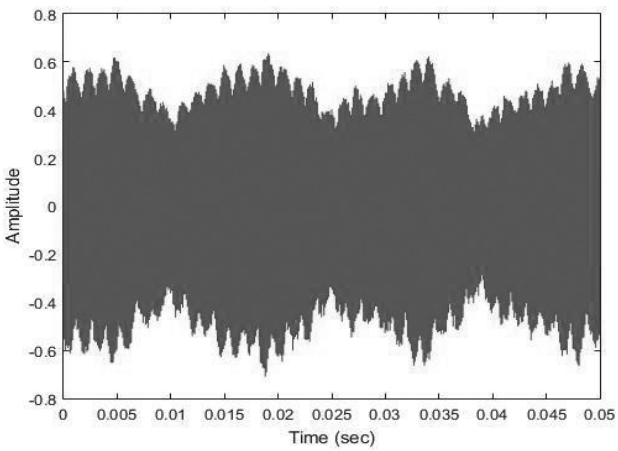
Figure 6 - Examples of environments and drills for data acquisition. (a) Actual working environment of setup a microphone, (b) The tip of a good drill, (c) The tip of a damaged drill.



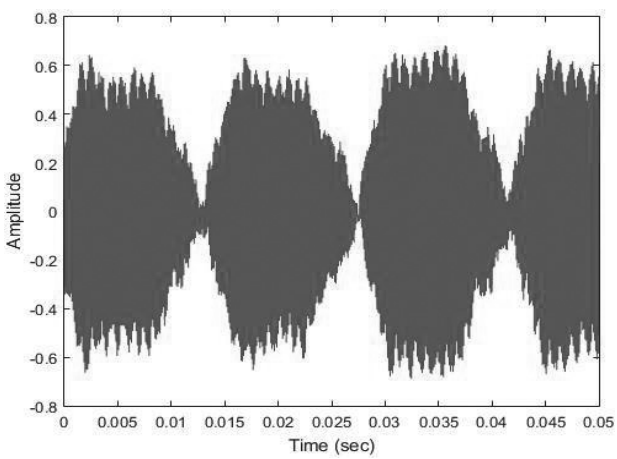
(a)



(b)



(c)



(d)

Figure 7 - Four data sounds randomly selected from our dataset. (a)-(b) Normal data signal, (c)-(d) Abnormal data signal due to damaged.

Results and discussion

In general, machine learning goes through two steps of feature extraction and pattern classification. However, we used time series data as input for pattern classification without feature extraction. This is because only two data, normal and abnormal, are used. Also we've segmented the recorded sound into many parts to construct our dataset.

Figure 8 shows our network will have 2205 inputs neurons. Our network has 3 layers. The input layer has 2205 neurons, the hidden layer has 10 neurons and the last layer has 2 neurons for our 2 instances (normal and abnormal).

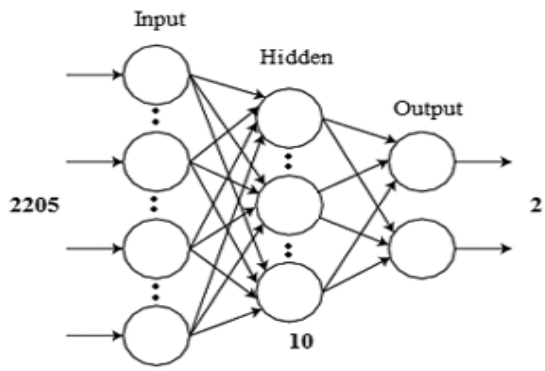


Figure 8 - Network structure: 2205 -- 10 – 2.

Experiments were conducted using MATLAB, and Figure 9 shows the performance progress. The results are really convincing and the performance, computed by using the mean square error is really low (perfomance of neural network for the validation dataset=0.0036). The convergence has been completed after 49 iterations. Even though we used time series data without feature extraction, the learning time was 0.01 seconds and the performance was good.

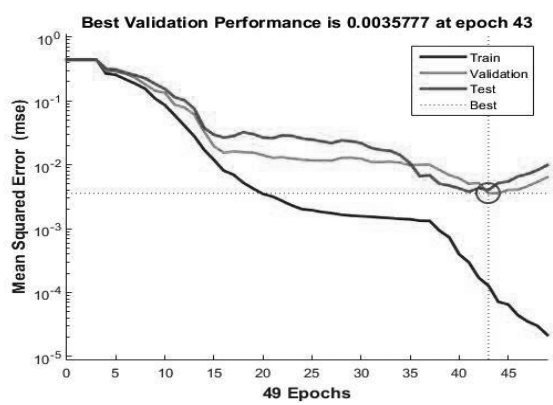


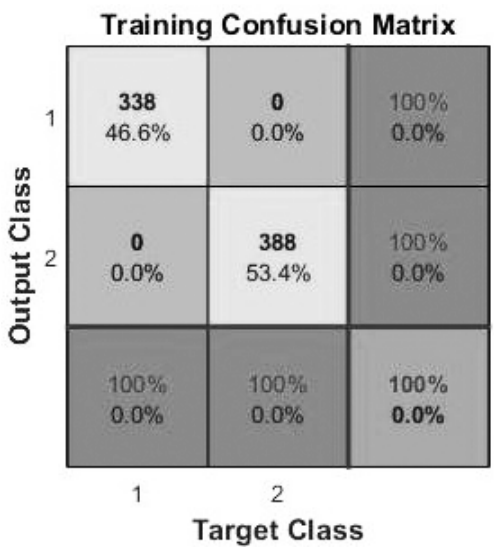
Figure 9 - Performance progress.

496 data were used for the normal state of the drill. 70% of these data were used for the training process, 15% for the testing and the other 15% for the validation dataset. 542 data were used for the abnormal state of the drill. 70% for training, 15% for testing and 15% for validation.

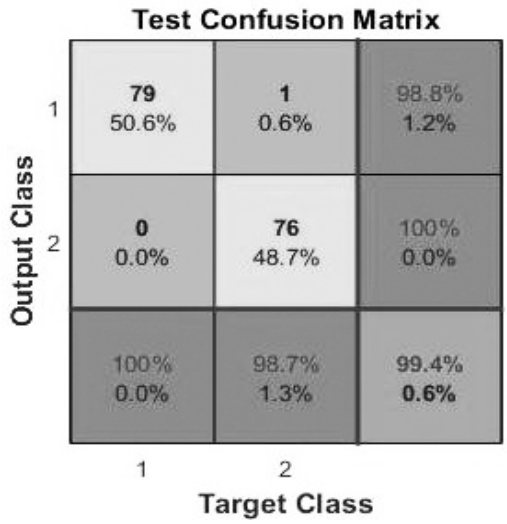
In the steady state drill, 338 of the 496 data were used as training data. In the abnormal condition drill, 388 of the 542 data were used as training data. The learning was successful, and the classification results are as follows.

For the normal state, 79 unseen data were mapped correctly with 100% accuracy during testing. 79 data were classified correctly for the validation dataset (100% of accuracy too).

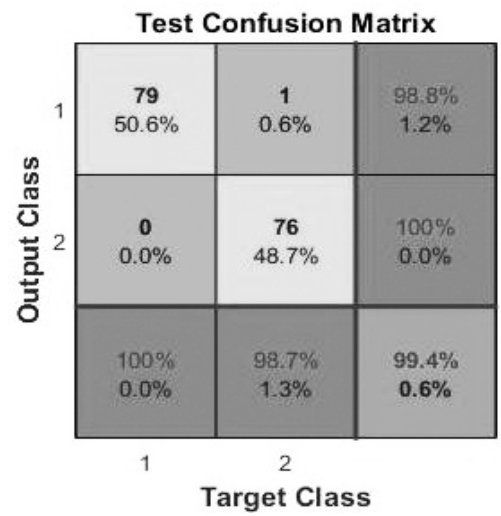
For the abnormal state of the drill, 76 data were classified correctly (98% of accuracy) and just 1 data was misclassified during testing. 76 other were well classified (98% of accuracy), just 1 data sounds were misclassified for the validation dataset. That gives 99.4% of accuracy for the testing and 99.4% for the validation. All the results are compiled in the confusion matrix for testing and validation in Figure 10.



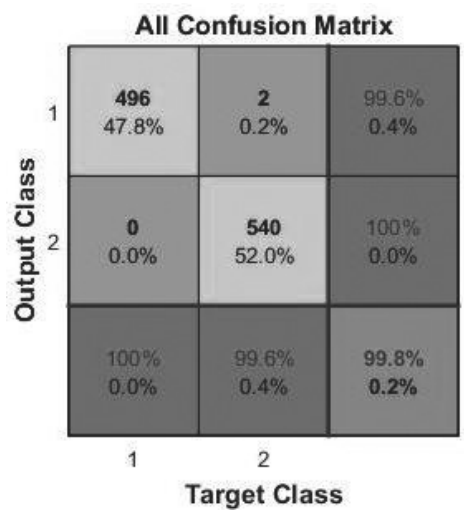
(a)



(b)



(c)



(d)

Figure 10 - The results. (a) Confusion matrix of training data (class 1 = good drill; class 2 = damaged drill), (b) Confusion matrix for testing data, (c) Confusion matrix for testing data, (d) Confusion matrix for all the dataset (including the training data).

Conclusion

Among the many problems in industries, the most important factor is for each machine systems to work in a normal state. In order to maintain a normal condition of a machine system, fault prediction and diagnosis systems are necessary. Condition monitoring of industries is evolving area in research. Fault diagnosis of machinery mostly uses vibration signals and AE signals, here sound signals are used. In this paper, we use the time series data of small data sets directly for pattern classification without feature extraction. This method showed a small learning time of 0.01 second and good performance. Normal and abnormal data can be easily separated. Now our research is to add feature extraction methods and apply them to non-separable datasets. The proposed method can be used in other fault diagnosis systems. If the normal and abnormal sound of the drill can be separated, it can also be used for vibration and other acoustic emission data.

Acknowledgments

This research was supported by the Technological Innovation R&D Program (C0407372) funded by the Small and Medium Business Administration (SMBA, Korea)", the MSIP(Ministry of Science, ICT and Future Planning), Korea, under the Grand Information Technology Research Center support program (IITP-2016-R7118161005000 1002) supervised by the IITP(Institute for Information & communications Technology Promotion), and the ICT R&D program of MSIP/IITP. [R0126-15-1112, Development of Media Application Framework based on Multi-modality which enables Personal Media Reconstruction].

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Smart Industry in the Digital Economy: Industrial Aspects and Production Systems

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McKinsey define the digital age as the fourth major upheaval in modern manufacturing, following the lean revolution of the 1970s, the outsourcing phenomenon of the 1990s, and the automation that took off in the 2000s. Hence, industry 4.0 as the next phase in the digitization of the manufacturing sector is driven by four disruptions [1]:

1. the astonishing rise in data volumes, computational power, and connectivity, especially new low-power wide-area networks;
2. the emergence of analytics and business-intelligence capabilities;
3. new forms of human-machine interaction such as touch interfaces and augmented-reality systems; and
4. Improvements in transferring digital instructions to the physical world, such as advanced robotics and 3-D printing.

Table 1: From Industry 1.0 to INDUSTRIE 4.0

Fourth Industrial Revolution	Use of cyber-physical systems
Third Industrial Revolution	Use of electronic and IT systems that further automate production
Second Industrial Revolution	Introduction of division of labour and mass production with the help of electrical energy
First Industrial Revolution	Introduction of mechanical production facilities with the help of water and steam power

Source: DFKI 2011

The German Research Center for Artificial Intelligence (DFKI) explains that the Agrarian economy gave way to industrialisation which started in England more than 200 years' ago.

No matter how powerful the aspirations, conviction, and sheer determination of the CEO though, McKinsey's experience of working with strategic transformation in organisations helps them conclude that companies must also get five other important dimensions right if they are to overcome organizational inertia, shed deeply ingrained steady-state habits, and create a new long-term upward momentum [2]. They must,

1. identify the company's full potential; set a new pace through a transformation office (TO) that is empowered to make decisions;
2. reinforce the executive team with a chief transformation officer (CTO);
3. change employee and managerial mind-sets that are holding the organization back; and
4. embed a new culture of execution throughout the business to sustain the transformation. This is in some ways the most difficult task of all.

A transformation with a capital *T*, which McKinsey defines as an intense, organization-wide program to enhance performance (an earnings improvement of 25 percent or more, for example) *and* to boost organizational health. When such transformations succeed, they radically improve the important business drivers, such as topline growth, capital productivity, cost efficiency, operational effectiveness, customer satisfaction, and sales excellence. Because such transformations instill the importance of internal alignment around a common vision and strategy, increase the capacity for renewal, and develop superior execution skills, they enable companies to go on improving their results in sustainable ways year after year. These sorts of transformations may well involve exploiting new digital opportunities or accompany a strategic rethink. But in essence, they are largely about delivering the full potential of what's already there.

For managers targets meant accountability—and, when missed, adverse consequences for their own compensation. Their default reaction was "let's under promise and over deliver."

To counter this natural tendency, CEOs as leaders should demand a clear analysis of the company's full value-creation potential: specific revenue and cost goals backed up by well-grounded facts. In the experience of the McKinsey team, targets that are two to three times a company's initial estimates of its potential are routinely achievable.

How can international companies profit from INDUSTRIE 4.0?

The German Research Center for Artificial Intelligence describes INDUSTRIE 4.0 as an industrial not a political revolution. A period of dynamic development which enable new resource-efficiency optimization processes that make environmentally friendly and urban production at acceptable costs possible in the near future – not only in Germany but across the world. It adds that INDUSTRIE 4.0 will therefore make a significant contribution to the biggest problems facing society; be it climate change, energy transformation or mega-city management.

Manufacturing industry is considered as the wealth-producing sector of a country. Successful manufacturing in the digital age is technology-driven. This success requires design improvements to conventional industrial age manufacturing systems and processes that will, for instance, reduce the amount of wastage and improve quality and productivity[4] . This is when Advanced Manufacturing Technologies (AMTs) come into their own enhancing the efficiency and flexibility of manufacturing systems (Wu, 2012). In addition, AMTs enable industries to stay technologically advanced, competitive and responsive to the scarcity of resources. AMTs are a group of computer-based technologies that include Computer-Aided Design (CAD), robotics, Group Technology (GT), Flexible Manufacturing Systems (FMS), automated material handling systems, storage and retrieval systems, Computer Numerically Controlled (CNC) machine tools, and barcoding or other automated identification techniques (Park, 2000; Percival and Cozzarin, 2010)

The diffusion of new technologies into value added manufactured goods has been enabled by globalization and the fragmentation of production into countries that are rising to these opportunities internationally. The need for manufacturing to produce more with less, to a higher standard and quality and to reach their markets and discerning customers who in larger numbers seek customized offerings faster than ever require capabilities to promote innovation systems.

In the electronics industry earlier generations of software systems applied to electronics manufacturing achieved limited benefits while introducing additional costs. Hence, experienced managers needed to be persuaded that the new Smart Factory or solutions related to Industry 4.0 offered real improvements and efficiencies [3].

Michael Ford [3] from the Mentor Graphics Corporation reviewed the real advances seen recently in the electronics sector. For instance, relative to methods used in the past, Mentor Graphics introduced Open Manufacturing Language (OML) (Appendix 1) for gathering data on the factory floor and it has the capability to record almost unlimited amount

of data on every aspect of the processes involved. Given that the most fundamental uses for the data collected is for asset utilization and productivity, loading a database such as the cloud with this data in itself will not yield useful outcomes. In IT terms sending data to the cloud, through ERP or MES only makes the cloud becomes saturated with huge amounts of unprocessed and difficult to process data. For instance if you take a PCB or assembly, a range of data is collected, most of which is only available in real-time such as:

- Arrival of the unique product at the process
- Start of the production cycle
- Completion of the production, etc

It is clear that in most operations within electronics during a single operational production flow, end-to-end, many messages are generated each second. With several concurrent production flows in the factory, and with some of the messages containing many kilobytes of data, the substantial amount and complexity of the bill of materials and the number and diversity of the various production processes is over whelming. When collecting this level of detail the cloud no longer looks a promising option and standard analytical tools struggle to crunch these into meaningful reports. However, while the latest generation of business intelligence or data analytics software is able to deal with this information overflow there still remained one further problem. Frequently the data collected on the problems within a process is mainly the symptoms and not the cause. For instance, if a PCB does not arrive at the next station the data collected by OML is of the symptom without any information of why? This is typical for machine-based reports where it is estimated that 80% of the information is just symptom, without any known reason or cause. Smart computerization, on the other hand, can take the "Waiting for PCB" message and start the process to discover the reason behind the event. Smart computerization being a more integrated whole system can identify the relevant process immediately before together with the cause.

When this qualified data i.e. the event has been fully explained by the computerization, is put into the cloud the data analytics software becomes practical and usable even with the huge amounts of data still required.

In addition smart computerization can also be used to extract more value. For example, local data storage of normalized and qualified events by the computerization is available, which also makes that data available for Smart systems, such as asset utilization and productivity reporting.

Coming back to the global challenges ahead, AMTs are needed to meet challenges in production systems. It is important to note that Additive Manufacturing (AM) where layers of components are added as necessary, subtractive manufacturing in contrast removes material from solid blocks to manufacture goods, and Distributive Manufacturing (DM) where components need not be produced on site are going to be very important. For instance, AM reduces waste because it only uses the materials needed to produce a product. The process also reduces the need to maintain large inventories of component parts because they can be produced using just-in-time. The US and Europe lead on AM. However, given the substantial investment China has been making in recent years it is expected to become a major player within 5-10 years.

In conclusion, the stage has been set for cyber-physical systems to provide industry 4.0 opportunities and new solutions to global challenges and the Smart Factory is beginning to take off. However, concurrently new challenges are emerging, that of cyber security and risk, ethics and governance and the effects on society when artificial intelligence and robotics replace people in workplace.

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Appendix 1: Definitions

- **Open Manufacturing Language (OML)** is a single, normalized, vendor-neutral communications standard for PCB production—including assembly, inspection, test and rework—that supports the Internet of Manufacturing.
- **Enterprise resource planning (ERP**) is business process management software that allows an organization to use a system of integrated applications to manage the business and automate many back office functions related to technology, services and human resources
- A **manufacturing execution system (MES)** is a control system for managing and monitoring work-in-process on a factory floor. ... Although manufacturing execution systems used to operate as self-contained systems, they are increasingly being integrated with enterprise resource planning (ERP) software suites.
- A **PCB (Printed Circuit Board)** is a thin board made of fiberglass, composite epoxy, or other laminate material. Conductive pathways are etched or "printed" onto board, connecting different components on the **PCB**, such as transistors, resistors, and integrated circuits. PCBs are used in both desktop and laptop
- **SMT (surface mount technology)** component placement systems, commonly called pick-and-place **machines** or P&Ps, are robotic **machines** which are used to place surface-mount devices (SMDs) onto a printed circuit board (PCB).

Keynote Speech

Technology and Management Education for Intelligent Society

- Namjae Cho (Conference General Chair, Hanyang U., Korea)

Business and Technology Education for The Coming Intelligent Society

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M.S. Management Science, KAIST
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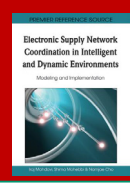


National Academy of Science Award

Emergence of Intelligent Society

Intelligent Society is

a society where intelligence technology becomes a critical and ubiquitous part of most human activities.

Education for technology and management preparing for Intelligent Society

Should prepare the students

- to contribute to developing desirable future
- to contribute to solving dark side problems

By understanding the economic, social, and individual dimensions of intelligent society.

Dimensions of Intelligent Society

Intelligence Technology

- Economic Activities
- Social Interaction
- Personal Life

Dimensions of Intelligent Society

Intelligence Technology

- **Economic Activities**
- Social Interaction
- Personal Life

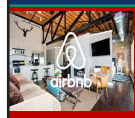
Intelligence Technology and Economic Activities

4th Industrial Revolution

- smart factory
- smart process
- smart collaboration

Sensor Network | Intelligent Robots | Dynamic Coordination | Remote Connectivity | Deep Learning

Intelligence Technology and Economic Activities



Sharing & Self-sustaining Economy

- sharing products and resources
- sharing knowledge and design
- additive manufacturing

Social Network | Crowd Sourcing | 3 D Printing | Block-chain Currency | Big Data Analysis

Intelligence Technology and Economic Activities

Dark Side & Challenges

- digital divide
- income divide and unemployment
- disruption of work-life identity

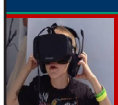
About 4 million jobs
will be replaced by robots
in the US only.

Dimensions of Intelligent Society

Intelligence Technology

- Economic Activities
- **Social Interaction**
- Personal Life

Intelligence Technology and Social Interaction



Extensively Networked Virtual Society

VR/AR Interfaces | High Mobility | Simulated Interaction | Work-life Spill-over | Non-place Interaction

Intelligence Technology and Social Interaction

Socio-politico-economic interaction

Agora Participation | Digital Senior | Virtual Commerce | Sense of Justice | Empathic Civilization

Every individual with a composite citizen-voter-consumer identity.

Intelligence Technology and Social Interaction

Dark Side & Challenges

- demise of social skill and sensibility
- identity crisis and transformed citizenship
- borderline identity

Excessive interaction without direct social contact.

Dimensions of Intelligent Society

Intelligence Technology

- Economic Activities
- Social Interaction
- **Personal Life**

Intelligence Technology and Personal Life


Physical personal life

DNA Checkups & Analysis

Virtual Entertainment

Advanced Personal Mobility

Remote Medical Services

Internet of Things


Intelligence Technology and Personal Life


Post-human Transformation

Extended Brain

Existential Identity

Machine Rights

Family Life Transformation

Cyborg Co-evolution


Robots: Family and Nursing




Intelligence Technology and Personal Life

Dark Side & Challenges

- privacy issues
- information ownership
- pursuit of happiness without 'work'

IoT with extensive network of sensors extends Privacy Risks.

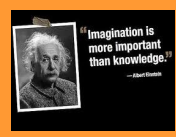
Suicide society.

Business and Technology for the Intelligent Society.

Rather than competing against intelligent technology

Focus on distinctive human ability.

Human-centered Resources



Creativity

&

Humanity
(Justice, Desire, Goodwill, & Trust)

Fusion : intrinsic Creative Thinking approach in human history

Garuda
National Museum of Indonesia

Persepolis, Iran

Dali House, Paris, France

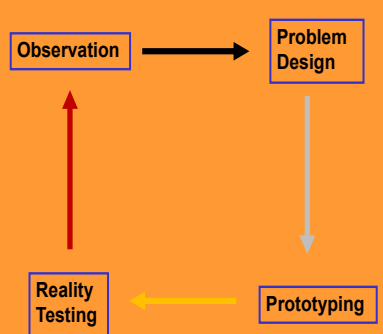
Creativity through Design Thinking

- In design, the problem and the solution 'evolve together.'
- Successful designers fundamentally recast the purpose, function, and role of a product.
- Design process is basically a "mental discourse" with the situation.

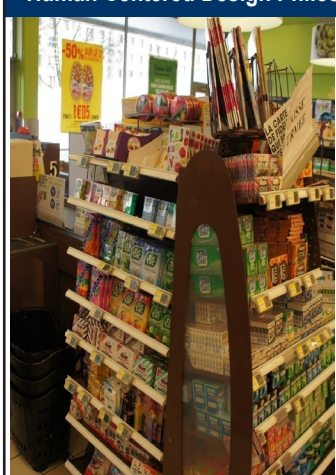
Philip Stark

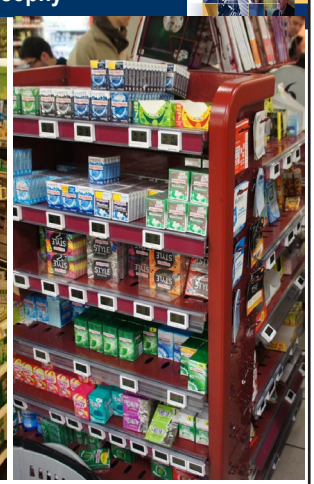
Nigel Cross, Design Colloquium 4 (2011)

Design Thinking Approach



Human Centered Design Philosophy





Human Centered Design Philosophy

"Since the birth of modern day supermarket,
sweets and carbon beverages
are located right besides the counter,
while daily necessities such as milk, butter, breads
(seniors and children may also need to pick up)
are located at the far back of the store."

Design for the Real World, Academy Chicago Publishing, 1984
Victor Papanec (winner of Alternative Nobel Prize)

THANKS

Lake Dal, Srinagar, Kashmir, India