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CONTENTS

Sr. No.	TITLE & NAME OF THE AUTHOR (S)	Page No.
1.	SIGNIFICANCE OF COST MANAGEMENT TECHNIQUES IN DECISION MAKING: AN EMPIRICAL STUDY ON ETHIOPIAN MANUFACTURING PRIVATE LIMITED COMPANIES (PLCs) <i>DR. FISSEHA GIRMAY TESSEMA</i>	1
2.	TECHNICAL EFFICIENCY ANALYSIS AND INFLUENCE OF SUBSIDIES ON THE TECHNICAL EFFICIENCY OF FARMS IN THE SLOVAK REPUBLIC <i>DR. ING. ANDREJ JAHNÁTEK, DR. ING. JANA MIKLOVIČOVÁ & ING. SILVIA MIKLOVIČOVÁ</i>	10
3.	A COMPARISON OF DATA MINING TECHNIQUES FOR GOING CONCERN PREDICTION <i>FEZEH ZAHEDI FARD & MAHDI SALEHI</i>	14
4.	DETERMINANTS OF CONSTRAINTS TO LOW PROVISION OF LIVESTOCK INSURANCE IN KENYA: A CASE STUDY OF NAKURU COUNTY <i>THOMAS MOCHOGE MOTINDI, NEBAT GALO MUGENDA & HENRY KIMATHI MUKARIA</i>	20
5.	PERCEPTIONS OF ACCOUNTANTS ON FACTORS AFFECTING AUDITOR'S INDEPENDENCE IN NIGERIA <i>AKINYOMI OLADELE JOHN & TASIE, CHUKWUMERIJE</i>	25
6.	AN ASSESSMENT OF MARKET SUSTAINABILITY OF PRIVATE SECTOR HOUSING PROJECT FINANCING OPTIONS IN NIGERIA <i>I.S. YESUFU, O.I. BEJIDE, F.E. UWADIA & S.I. YESUFU</i>	30
7.	AN EXPLORATORY STUDY ON THE PERCEPTION OF CUSTOMERS TOWARDS THE ROLE OF MOBILE BANKING, AND ITS EFFECT ON QUALITY OF SERVICE DELIVERY, IN THE RWANDAN BANKING INDUSTRY <i>MACHOGU MORONGE ABIUD, LYNET OKIKO & VICTORIA KADONDI</i>	35
8.	BUSINESS PROCESS REENGINEERING AND ORGANIZATIONAL PERFORMANCE <i>C. S. RAMANIGOPAL, G. PALANIAPPAN, N. HEMALATHA & M. MANICKAM</i>	41
9.	CUSTOMER PERCEPTION OF REAL ESTATE SECTOR IN INDIA: A CASE STUDY OF UNORGANISED PROPERTY ADVISORS IN PUNJAB-INDIA <i>DR. JASKARAN SINGH DHILLON & B. J. S. LUBANA</i>	46
10.	INNOVATIVE TECHNOLOGY AND PRIVATE SECTOR BANKS: A STUDY OF SELECTED PRIVATE SECTOR BANKS OF ANAND DISTRICT <i>POOJARA J.G. & CHRISTIAN S.R.</i>	51
11.	THE PROBLEMS AND PERFORMANCE OF HANDLOOM COOPERATIVE SOCIETIES WITH REFERENCE TO ANDHRA PRADESH INDIA <i>DR. R. EMMANIEL</i>	54
12.	IMPACT OF GENDER AND TASK CONDITIONS ON TEAMS: A STUDY OF INDIAN PROFESSIONALS <i>DEEPIKA TIWARI & AJEYA JHA</i>	58
13.	MOTIVATIONAL PREFERENCES OF TEACHERS WORKING IN PRIVATE ENGINEERING INSTITUTIONS IN WESTERN INDIA REGION: AN EXPLORATORY STUDY <i>DD MUNDHRA & WALLACE JACOB</i>	68
14.	CHANNEL MANAGEMENT IN INSURANCE BUSINESS <i>DR. C BHANU KIRAN & DR. M. MUTYALU NAIDU</i>	74
15.	MANAGEMENT INFORMATION SYSTEM APPLIED TO MECHANICAL DEPARTMENT OF AN ENGINEERING COLLEGE <i>C.G. RAMACHANDRA & DR. T. R. SRINIVAS</i>	78
16.	A STUDY ON THE PERCEPTIONS OF EMPLOYEES ON LEADERSHIP CONCEPTS AND CONSTRUCTS IN LIC <i>H. HEMA LAKSHMI, P. R. SIVASANKAR & DASARI.PANDURANGARAO</i>	83
17.	TEXTURE FEATURE EXTRACTION <i>GANESH S. RAGHTATE & DR. S. S. SALANKAR</i>	87
18.	INDIAN BANKS: AN IMMENSE DEVELOPING SECTOR <i>PRASHANT VIJAYSING PATIL & DR. DEVENDRASING V. THAKOR</i>	91
19.	DEVALUATION OF INDIAN RUPEE & ITS IMPACT ON INDIAN ECONOMY <i>DR. NARENDRA KUMAR BATRA, DHEERAJ GANDHI & BHARAT KUMAR</i>	95
20.	SERVICE PRODUCTIVITY: CONCERNS, CHALLENGES, AND RESEARCH DIRECTIONS <i>DR. SUNIL C. D'SOUZA</i>	99
21.	A STUDY OF THE MANAGERIAL STYLES OF EXECUTIVES IN THE MANUFACTURING COMPANIES OF PUNJAB <i>DR. NAVPREET SINGH SIDHU</i>	105
22.	FINANCIAL LEVERAGE AND IT'S IMPACT ON COST OF CAPITAL AND CAPITAL STRUCTURE <i>SHASHANK JAIN, SHIVANGI GUPTA & HAMENDRA KUMAR PORWAL</i>	112
23.	REACH OF INTERNET BANKING <i>DR. A. JAYAKUMAR & G.ANBALAGAN.</i>	118
24.	THE PROPOSED GOODS AND SERVICE TAX REGIME: AN ANALYSIS OF THE DIFFERENT MODELS TO SELECT A SUITABLE MODEL FOR INDIA <i>ASHISH TIWARI & VINAYAK GUPTA</i>	122
25.	ESTIMATION OF STOCK OPTION PRICES USING BLACK-SCHOLES MODEL <i>DR. S. SARAVANAN & G. PRADEEP KUMAR</i>	130
26.	MIS AND MANAGEMENT <i>DR.PULI.SUBRMANYAM & S.ISMAIL BASHA</i>	137
27.	REFORMS IN INDIAN FINANCIAL SYSTEM: A CONCEPTUAL APPROACH <i>PRAVEEN KUMAR SINHA</i>	147
28.	NATURAL RUBBER PRODUCTION IN INDIA <i>DR. P. CHENNAKRISHNAN</i>	151
29.	QUALITY IMPROVEMENT IN FREE AND OPEN SOURCE SOFTWARE PROJECTS <i>DR. SHAIK MAHABOOB BASHA</i>	157
30.	ICT & PRODUCTIVITY AND GROWTH BUSINESS: NEW RESULTS BASED ON INTERNATIONAL MICRODATA <i>VAHID RANGRIZ</i>	160
	REQUEST FOR FEEDBACK	165

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OBJECTIVES

HYPOTHESES

RESEARCH METHODOLOGY

RESULTS & DISCUSSION

FINDINGS

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QUALITY IMPROVEMENT IN FREE AND OPEN SOURCE SOFTWARE PROJECTS

DR. SHAIK MAHABOOB BASHA
LECTURER
DEPARTMENT OF COMPUTER SCIENCE
GOVERNMENT DEGREE COLLEGE
NANDIKOTKUR

ABSTRACT

Free and Open Source software has had major impact on the computer industry. Free and Open Source software or FOSS allows the different groups to share their source code. Open source projects are developed by students as well as developers. Some of the best examples are MySQL, relational database, the Apache Web Server and the Sendmail mail transport agent. It has made life easy enabling us to develop applications pertaining to our requirements. We can use other applications by modifying their basic codes, thus enabling power into our hands. There is a scope in developing applications based on cyber security. It is easier and faster to process information. The sudden success and major adoption of this new and innovative software development strategy has raised many questions, attracted the interest of academics in a variety of disciplines and promoted interdisciplinary research. Licensed software guarantees unrestricted use, access to the source code, and the right to modify and to distribute source code. Free Software is associated with a strong philosophical focus on freedom, adherents of the open source movement stress features of the software, such as high quality. FOSS is now used in many areas, such as the Internet.

KEYWORDS

FOSS, MySQL, source code, Apache, Web Server, Send mail.

INTRODUCTION

FOSS is a combination of ideas of communities which cooperatively develop and share software and its source code can be traced back several decades to the origin of the modern computers. FOSS is a license model for software distribution. Unlike traditional software, this is inherently associated with the protection of proprietary rights. FOSS encompasses a class of licenses which give the user a number of rights and permissions. A FOSS development tool has led to the production of software of significant quality and functionality. There is growing interest in understanding and utilizing the process underlying FOSS development. Various FOSS applications such as Apache and Linux have attained major market share and often dominate their product categories. Major players in the IT sector such as IBM & HP have invested billions of dollars in FOSS development. Furthermore companies like Red Hat which commercialize Linux have attained considerable profit. The collaborative innovation process employed by FOSS projects is often seen as a major organizational innovation. In recent years new attention has been given in the literature to the identification of new processes in software production and other areas of technology that allow organizations to cope with rapid change

QUALITY IMPROVEMENT IN FOSS PROJECTS

The measurement of quality cannot directly be applied to FOSS projects which usually do not have an explicit design or written specifications. Nevertheless, the idea of fitness for purpose applies to any product including FOSS. Many different factors have to be taken into consideration for quality. After all, users have to download and install FOSS themselves and they will usually choose software which fulfils their needs and quality expectations. There are many approaches to quality improvement. The predominant view of quality improvement is process thinking. A high quality product can be created through a high quality process. Quality and productivity increase as 'process variability' Quality improvement can only be achieved in a company through the participation of everyone in the workforce. This view is the compatible with process improvement which takes all aspects of the process into account, including developers and other people participating in the development process. Process improvement view with the aim to find problems with processes employed by FOSS projects to identify ways to improve there process and to find best practices. There are many FOSS projects which have attained significant popularity and quality. There is also growing literature that empirically backs up the anecdotal evidence that FOSS is of higher than expected and there are other empirical studies which show that FOSS is comparable or better than proprietary, closed source software with regards to various quality factors. However these studies have to be regarded with some caution. First, it is not clear what software could act as a basis for comparison. Second, it is easy to misinterpret a given indicator. For example, a high number of reported defects can either indicate buggy and low quality software, but is could also mean that the software is rigorously tested. Finally code quality is only one measure of quality and there are other areas in which FOSS projects do not outperform closed source applications, such as usability.

QUALITY PROBLEMS

The qualities problems that have been identified are yet to be solved in the FOSS community are

- 1) **Unsupported code** : one of the unsolved problems is how to handle code that has previously been contributed but which is now unmaintained. A contributor might submit source code to implement a specific feature to an obscure hardware architecture. As changes are made by other developer, this particular feature has to be updated so that it will continue to work. Unfortunately, some of the original contributors may disappear and the code is left unmaintained and unsupported. Lead developers face the difficult decision of how to handle this situation.
- 2) **Configuration management**: many FOSS projects offer a high level of customization. While this gives users much flexibility, it also creates problems with testing. It is very difficult or impossible for the lead developer to test all combinations so only the most popular configurations tend to be tested. It is quite common that, when a new release is made, users report that the new version broke their configuration.
- 3) **Security updates** : updates in many cases they are made in a timely manner but some
- 4) **Users do not know to report bugs** as more users with few technical skills use FOSS, developers see an increase in useless bug reports. In many cases users do not include enough information in a bug report or they file duplicate bug reports. Such reports take unnecessary time away from actual development work. Some projects have tried to write better documentation about reporting bugs but they found that users often do not read the instructions before reporting a bug.
- 5) **Attracting volunteers**: a problem some projects face, especially those that are not very popular, is attracting volunteers. There are usually many ways of contributing to a project, such as coding, testing or triaging bugs. However, many projects only find prospective members who are interested in developing new features. Few contributors are interested in helping with testing or triaging bugs. As a result, developers have to use a large portion of their time for tasks other people could easily handle.
- 6) **Lack of documentation**: it is possible that the previous problem is related to the lack of documentation. Volunteers may want to contribute in an area but they might not know how to start. Little help is given to prospective contributors and almost no documentation exists. The lack of developer documentation also implies that there is no assurance that everyone follows the same techniques and procedures.
- 7) **Problems with coordination and communication**: in some projects, there are problems with coordination and communication which can have a negative impact on project quality. Sometimes it is not clear who is responsible for a particular area and therefore bugs cannot be communicated properly. There may also be duplication of efforts and a lack of coordination related to the removal of critical bugs.

PROBLEMS WITH THE FOSS

The different problems identified from the traditional development which are most commonly cited

- FOSS systems are built by potentially large numbers of volunteers
- Work is not assigned; people undertake the work they choose to undertake.
- There is no explicit system-level design, or even detailed design.
- There is no project plan, schedule or list of deliverables.

RELEASE MANAGEMENT IN FOSS

Release management in FOSS is an area which is largely unexplored. FOSS is characterized by a highly iterative development model in which new development releases are made available very frequently. The aim of the release approach is to gather feedback early and it allows the community to influence the direction of a project. The three types which have been identified are: development releases aimed at developers interested in working on the project or experienced users who need cutting edge technology major user releases based on a stabilized development tree these releases deliver significant new features and functionality as well as bug fixes to end user and are generally well tested minor releases as updates to existing user releases for example to address security issues or critical defects since developers are experts development releases do not have to be polished and are therefore relatively easy to prepare minor updates to stable releases also require little work since they usually only consist of one or two fixes for security or critical bugs on the other hand a new major user release requires significant efforts the software needs to be thoroughly tested, various quality assurance tasks have to be performed, documentation has to be written and the software needs to be packaged up in terms of release authority, it can be observed that major new user releases are typically performed by the project leader or a dedicated release manager where as development and minor user releases can also be prepared by a core member of the development team this again shows the significance that user releases have

Project	Version control system
GCC	SVN
GNOME	CVS, SVN
Nano	CVS
Synaptic	Bzr
X.org	git, SVN

Version Control Systems used by some Projects

PREPARATION OF STABLE RELEASES

The act of preparing a stable release for end-users is a complex set of tasks in which all developers of a project have to work together to deliver a high Quality product. While the specific release approach may differ from project to project a common pattern has been identified: staged progress towards a release where each stage is associated with increasing levels of control over the changes that are permitted. These control mechanisms are usually known as freezes since the development is slowly halted and eventually brought to a standstill.

The role of the release manager is diverse and demanding, because they have to interact with a large number of different people, understand technical issues but also know how to plan and coordinate. The following taxonomy of skills and characteristics which release managers need has been developed.

1. Community building: showing people that their input is useful. Release managers also need respect in the community in order to perform their work.
2. Strong vision: showing developers in which direction the project should be moving.
3. Discipline: saying 'no' Release manager have to focus on an overall goal and can not make everyone happy.
4. Judgment: gauging the risk and possible impact of a particular change.
5. Attention to detail walking through every line of code that has changed.
6. Good communication: writing release notes, asking for feedback, interacting with users.
7. Management skills: talking to people, organizing, planning, making sure that all the little things happen.

COMPARISON OF PROPRIETARY SOFTWARE AND FOSS

Quality in either FOSS or closed proprietary software is necessarily higher. However many participants felt that FOSS had a higher potential to achieve greater quality and can react faster to critical issues such as security bugs. There are various reasons for this

- 1) Its open nature promotes more feedback, which can be used to improve the software. Feedback can either be given in the form of bug reports or feature requests.
- 2) Motivation was higher in FOSS projects because volunteers could work on whatever they wanted. Open collaboration with other developers and input from others also increase the motivation to work on a piece of software. It is found that this increased motivation had positive effects on the quality of the software.
- 3) FOSS could attract better human resources because of its distributed nature. FOSS can benefit from a wider range of expertise and knowledge than a traditional software company can usually bring to bear on a problem. A downside of community projects compared to commercial development was the lack of resources and infrastructure.
- 4) It is very hard to compare open and closed development models because of the opposing philosophy of these models. Since closed source companies often hide their defects and source code, it is hard to make a comparison.

DEVELOPMENT AND QUALITY PRACTICES

One of the surprising insights gained was how greatly development practices and processes differed across projects. The identified practices can be categorized broadly into the following three areas

INFRASTRUCTURE

FOSS projects rely heavily on infrastructure that allows distributed development and collaboration. The important parts are

- 1) Bug Tracking System: These are used to capture feedback from users. They are often used to store both actual bug reports as well as feature requests
- 2) Version Control Systems: - These allow multiple people to work on the same code base concurrently and keep track of who makes which changes.
- 3) Automatic Builds: - These make sure that the newest code in the version control system still builds. The test builds can be done on a number of different hardware or software environments.
- 4) Mailing Lists: - Used for communication, both between developers and users.

PROCESSES

Foss development follows many processes but a large number of them are not documented anywhere – developers adhere to them implicitly.

- 1) Joining: projects require prospective members to follow specific, mostly undocumented, procedures in order to join a project. These procedures vary considerably across projects.

- 2) Release: different release policies are employed by projects but many follow freeze stages. A feature freeze is the point when no new features are to be incorporated into the code base but there is sufficient time to fix bugs.
- 3) Branches: these are used to differentiate between versions of a program, for example by having a stable and a development branch. New development tools which make branches easier to deal with, such as Arch, have had a significant impact on the development process.
- 4) Peer review: typically changes made to the version control system are reviewed by members of the projects, though in most cases; this form of peer review is not very well formalized. Developers hope that other project participants will look at their changes but there is often no assurance that this is the case in reality.
- 5) Testing: in order to ensure that a new release fulfils the standards of a project and that it has no major regressions i.e. bugs that affect functionality that previously worked), some projects have testing check lists. These check lists contain the most important functions and briefly describe how they can be tested. A release is only made when testers on different platforms have gone through the check list and have confirmed that the new version does not display major show-stoppers or regressions.
- 6) Quality assurance: some organize bug days or bug squashing parties to triage their outstanding bugs. During this work, duplicate bug reports are marked as such, old bugs are reproduced, and bugs are also fixed.

DOCUMENTATION

Contributed source code was checked by the lead developer of a project and then rejected because it did not confirm to the coding style, a style that was not clearly documented anywhere. However, some projects, mainly those that have a large number of contributors, have good documentation.

- 1) Coding styles: documentation aimed at developers which describes the style which should be used for the source code.
- 2) Code commit: documentation which describes when and who can make changes in project's version control system.

CONCLUSION

A FOSS project has been substantial development in a number of areas. Since large corporations and others increasingly depend on FOSS. FOSS production has traditionally been perceived as unstructured and unorganized and the majority of FOSS projects consist of voluntary contributors. Corporations can rely on the output of FOSS projects based on quality and study aspects of quality improvement and find ways to ensure high levels of quality in the output of FOSS projects. Release management has been chosen as the specific focus. Time based release strategy as a novel concept of release management worth investigation-in-depth. In contrast to traditional software development which is feature-driven, the goal of time based release management is to produce high quality release according to specific release interval. It is found that feature based release management in FOSS projects is often associated with lack of planning, which leads to problems, such as delays and how levels of quality. Since the FOSS projects consist of volunteers, it is difficult to perform planning because there is no guarantee that features will be ready in time for the next release.

FOSS methodology has been used to develop a significant body of software some with high quality, there have been major changes in the expectations of FOSS in recent years. FOSS is no longer seen as hobby projects done for fun, but significant economic factors are involved now. This increased economic interest in FOSS with millions of users and thousands of organizations relying on this collaboratively developed software has led to new requirements, such as the need for sustainability and reliance

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