Usage of SWOT Analysis for Critical Evaluation of Existing Computerised Examination System for Implementation of Academic and Examination Reforms Under National Higher Education Mission- A Case Study of Himachal Pradesh University, Shimla, India

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Abstract—The introduction of National Higher Education Mission (NHEM) entitled "Rashtriya Uchchtar Shiksha Abhiyan (RUSA)" under the Ministry of Human Resource and Development, Government of India has been forcing the Indian Universities to reform their academic, examination and administrative sectors. The implementation of Choice Based Credit System (CBCS), semester mode, Continuous Comprehensive Assessment (CCA), etc. are a few academic reforms and these have direct impact on our legacy computerised examination system. In this paper, the existing computerised examination system of Himachal Pradesh University, Shimla is critically evaluated as a case study using SWOT analysis tool. The findings of the study provide a clear picture of available resources, their strengths and weaknesses in addition to potential opportunities and threats existing around our examination system. The results of this study indicate that university management needs comprehensive planning, vision and foresight to strengthen existing computerised examination system. This can be done by assigning priorities for critical tasks to be done besides implementation of academic, education and administrative reforms. Further there is also a need to correlate strengths with available opportunities to exploit them, use strengths to avoid threats, overcome the weaknesses by taking advantages of available opportunities and minimise weaknesses to avoid potential threats for successful implementation of computerised examination system.

Keywords— Data Quality, ICR, SWOT, TOWS, NKN

I. INTRODUCTION

With the passes of time, lots of changes have come in the universities' examination systems. The manual examination system was meant for times when there were fewer students and courses. However, at present, with the gross enrolment ratio in higher education is going up, the examination system has to bear an increased load and leading towards inefficiencies [1]. Except a few institutions, most affiliated institutions depend heavily upon university for administrative, examination- related and curricular matters. This amounts to an unnecessary burden on the university as it is reduced to an administrative and exam conducting body [2]. The manual compilation of results takes very long time to declare results. This in turn affects students because some of them lose chances to get admissions in next higher classes. The students have to correspond by post or visit the university in person for examination-related queries. Sometimes, it becomes difficult to retrieve information manually for a specific candidate among huge volume of papers based databases. The conventional paper-pen examination system is prone to errors, greater time consuming, inefficient and waste of valuable resources [1]. The students spent their valuable time and money for getting accurate information, but students are not getting this. They have to waste time and money for getting exam/result related information and sometimes to give bribes for the same due to several reasons. One of the main reasons is that in most of the Indian Universities, examination system is managed manually [3]. For universities, the ever-increasing paper-based record registers have made it difficult to store and manage information. There is repetition of work because the same data is represented in different forms by different branches. This leads to data duplication and huge money is being spent by the universities to buy paper and hire additional manpower. In addition to above, there are also chances of tampering with students' records, circulation of fake degrees, unfair practices, etc. [1]. The ICT has been facilitating some universities to manage examinations timely in a neat, clean and transparent manner. The main objectives of automation of examination systems are to minimise human intervention, curtail expenditures, bring efficiency, enhance productivity, optimal utilization of resources, better monitoring of examination activities to take quick decisions, timely availability of information/services for stakeholders, bring transparency, integration of isolated but related databases, minimise data redundancy, role-based access to users, reduce psychological pressure, improve public image, etc. In this paper, an attempt has been made to identify various strengths, weaknesses, opportunities and threats in existing computerised examination system of Himachal Pradesh University, Shimla as a case study using SWOT as well as TOWS analysis matrixes. Further, the observed strengths, weaknesses, opportunities and threats were correlated to each other to identify potential factors for implementation of academic and examination reforms under National Higher Education Mission.

II. COMPUTERISED EXAMINATION SYSTEM DEVELOPMENT- AN OVERVIEW

The development process of computerised examination system of Himachal Pradesh University has been divided into: 1) Functional Model, 2) Data Model, 3) User Interfaces, 4) Testing, and 5) Implementation.

A. Functional Model

In pre-examination phase, the examination forms received from different categories of students comprising of regular, private and correspondence are scrutinized by the concerned examination branches to check the eligibility of the appearing candidates. Thereafter, these are sent to computer centre for building of students' database and generation of different types of pre-examinations reports. In addition to above, the details of regular students are collected through small software utilities. The examinations forms of private and correspondence students are scanned followed by auto-recognition of data by ICR software "AutoRec", validations and confirmed by computer operators to obtain their examinations details. A database of students is built and processed to generate examination roll numbers and various types of pre-examination reports- admit card, cultists, attendance sheets, centre statement. These reports are verified by the concerned examination branches before sending them to the different stakeholders. So the pre-examination phase consists of following modules: 1) data entry/editing module, 2) scanning module, 3) roll numbers generation module, and 4) reports generation modules. The fig. 1 shows the functional modules of pre-examination system:
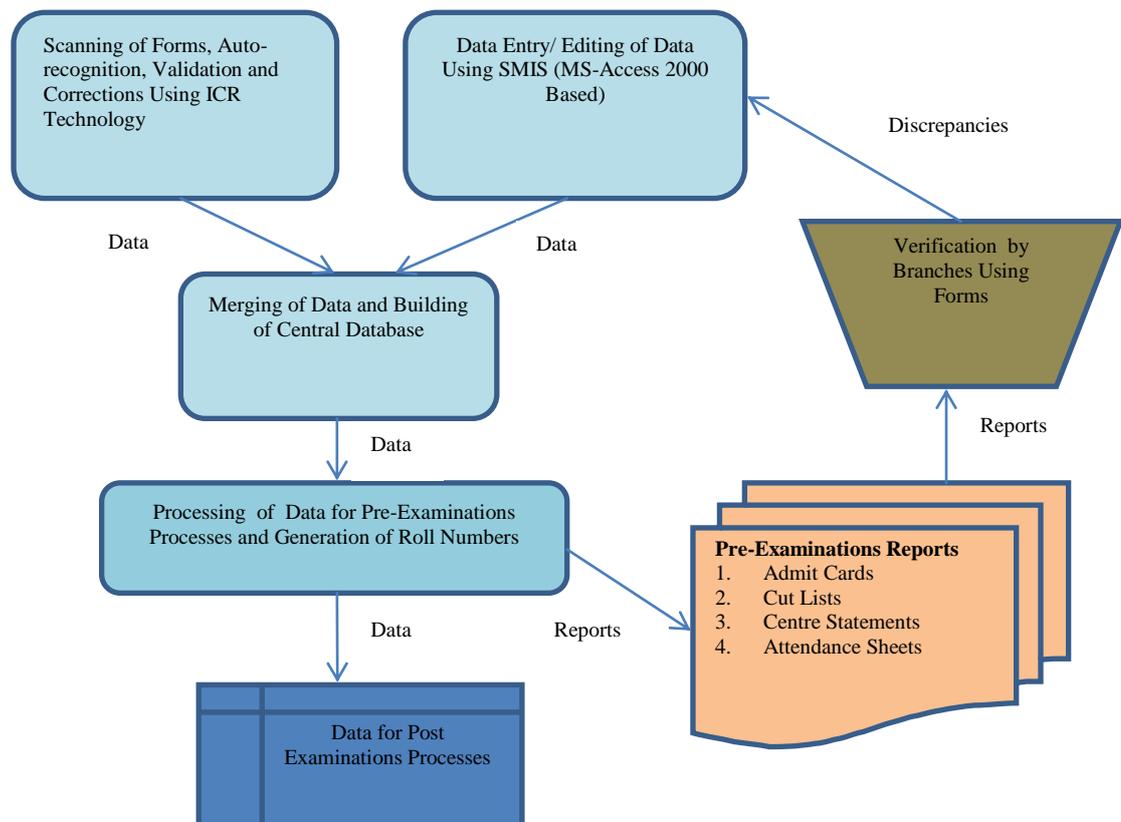

Fig. 1 Functional Model of Pre Examination System

The post-examination phase starts with data entry of awards using small software utilities entitled "Awards Management System" and 'Practical Awards Management System". In addition to above, the handwritten ICR compatible award lists are also prepared by the evaluators. The ICR compatible awards lists are scanned, auto-recognised by ICT software "AutoRec", verified and confirmation of data by the computer operators and databases of awards are prepared. Both the databases (manual entered awards and ICR recognised awards) are collated to find out any discrepancies. After removal of discrepancies, the awards database becomes clean and ready for compilation of results by using pre-examination database. The tabulation sheets are generated are sent for concerned examination branches are verification of entries followed by removal of identified discrepancies and final compilation of result. This phase ends with generation of various reports- gazettes, result cards, tabulation sheets, history sheets, etc. meant for different stakeholders- students, colleges/institutes and university. This system contains following modules: 1) data entry of awards, 2) scanning of award lists, 3) compilation of results using business rules, 4) generation of reports. The fig. 2 shows the functional modules of post-examination system. The compilation of results module is a complex module which further contains other sub-modules for choosing of appropriate subject/course combinations, differentiate students based on their appearing capacities-regular, private & correspondence, granting of grace marks, applying of pass/fail/reappear conditions, totalling of awards, mark absentees, checking of stray cases, etc. This functional module is very critical because success of entire examination system is dependent on it. The incorrect compilation of result may put the credibility of whole examination system under a big question mark.
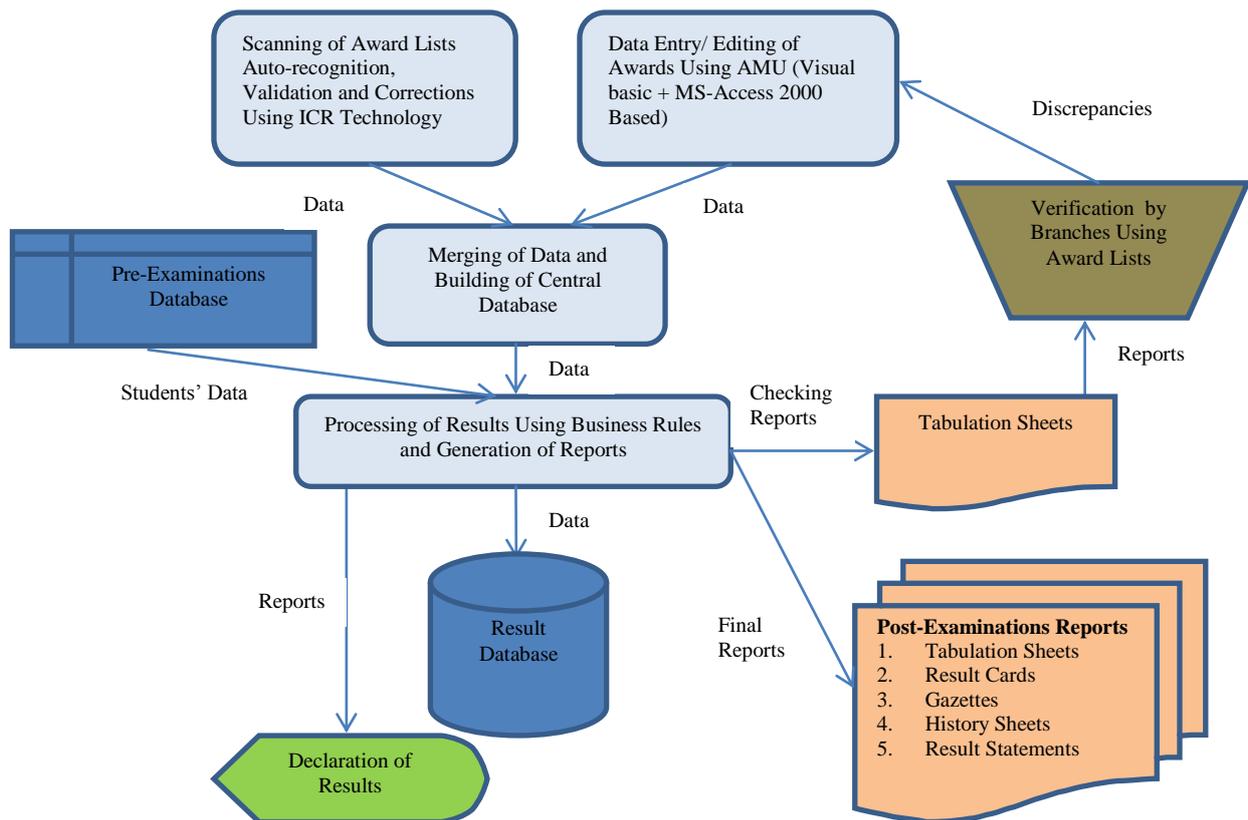
Fig.2 Functional Model of Post Examination System

The post result declaration phase starts after declaration of results and meant for students whose results could not declare due to certain reasons like late fee, migration issues, awards discrepancies, withheld of previous class result, etc. The small software (utility) entitled "Discrepancies Management System" built on using MS-Access platform is used for settlement of result discrepancies. This includes: 1) awards entry/editing, 2) correction in personal details, 3) compilation of result, and 4) printing of reports.

Data Model

The data modelling is abstraction of data which refers to supersession of details of data organisation and storage and the heightening of the essential features of an improved understanding of the data. The data model is collection of concepts that can be used to describe the structure of a database- provides the necessary means to achieve this abstraction. The data models also include a set of basic operations for specifying retrieval and updates on data [4]. The fig. 3 shows the snapshot of relationships among different logical and physical entities.
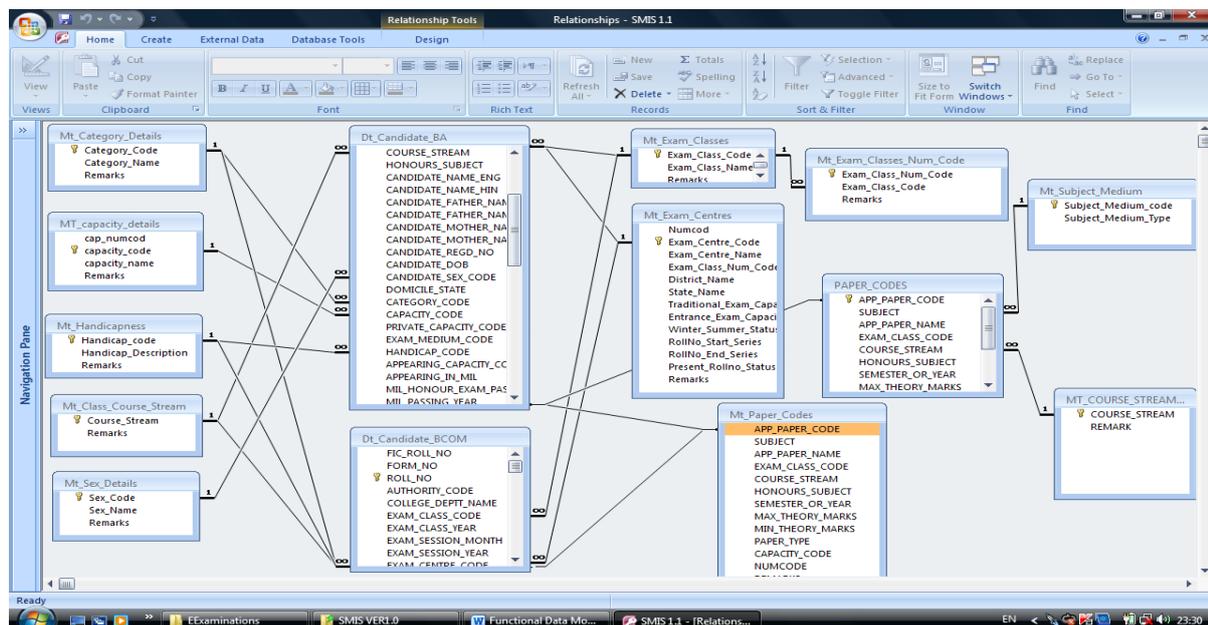

Fig. 3 Logical Database Design

The database is normalized upto third normal form to maintain data quality, minimize data redundancy and for removal of various data anomalies- insertion, deletion and updating. Every entity has primary key and master-details relationships were setup among appropriate entities using primary-foreign keys constraints. The main database contains total of 26 tables comprising of master, detailed and temporary/views in addition to other objects like functions, procedures, triggers and packages. Some of the procedures are dependent on other procedures/functions. The triggers fire automatically on meeting certain data insertion, updation and deletion events. This database has been logically divided into different tablespaces for easier backup and recovery, maintenance and security purposes. The result compilation work rests with Oracle server for the purposes of better control and maintenance of business logics only at one end.

B. User Interfaces

Attractive and user-friendly interfaces play very important role for successful system implementation. The prototyping technique has been used to refine users' interfaces. In existing system, related data fields have been categorized and organised in a specific orders for easy interaction to the users. The functionality of different forms has been further divided into: 1) user's authorization by asking username and password, 2) Menus for selection of different items, 3) Data Entry Forms embedded with different visual controls – listing, combo boxes, text boxes, check boxes, labels and command buttons 4) Data Reports, etc. The fig. 4 shows data entry form.
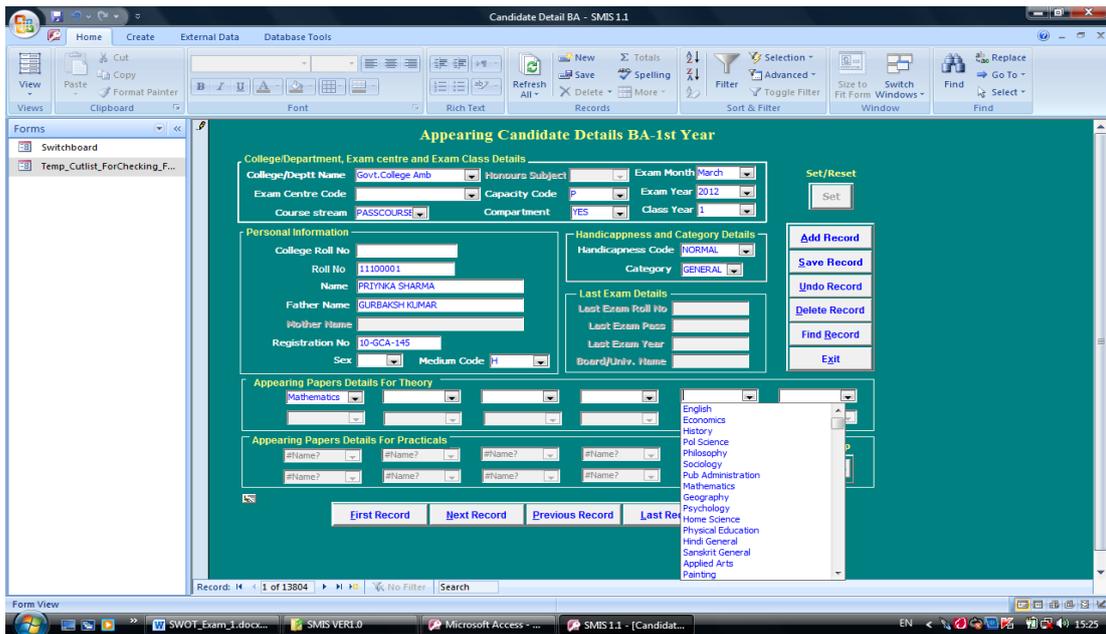

Fig. 4 Data Entry Form

After successful authorization, the application permits the user to perform permitted functions. The well-defined titles for forms and reports, appropriate sequencing of data items, organisation of data fields, clickable command buttons, etc. facilitate the users to effectively interact with system and get quality data for automation at university's end. The precise, neat and clean computer generated reports have replaced the traditional big size and bulky reports which were not only difficult to handle but also very space consuming. The fig. 5 shows data report of a tabulation sheet.
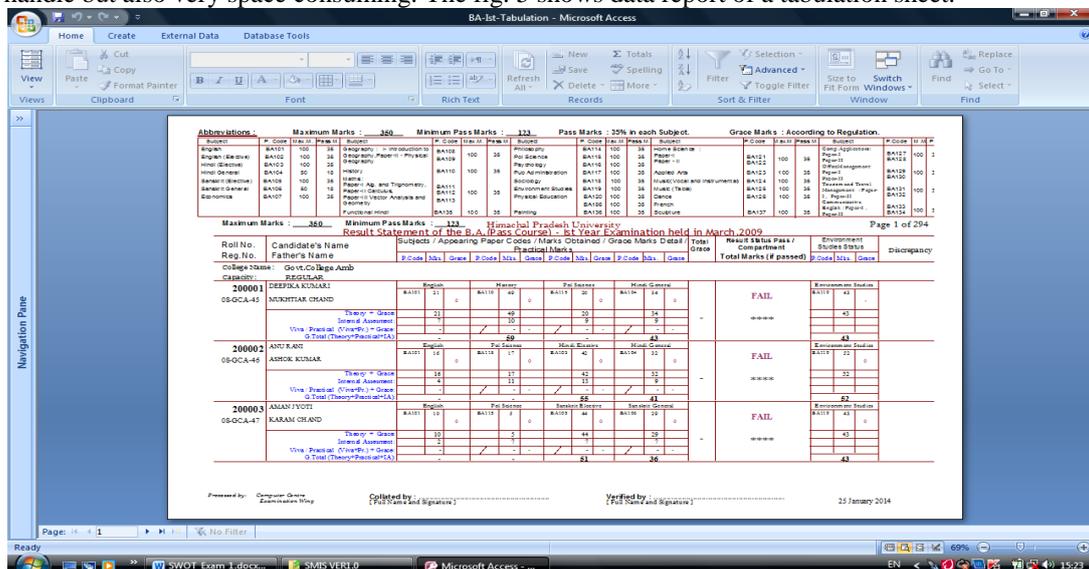

Fig. 5 Data Report of a Tabulation Sheet

C. Testing

The most important software assessment criteria are acceptability, usability, functionality, reliability and maintenance. The system was refined continuously using prototyping technique based on quality assurance criteria by asking feedbacks from users and their incorporation in next version. The Students Management Information System (SMIS), Practical Awards Management System (PAMS) and Term End Examinations Awards Management System (TEAMS) software utilities have been used by all colleges/institutes since 2006 exams without having any formal training. Every utility is supported with users' manual comprising of well illustrations of each and every feature.

D. Implementation

For implementation of this system, a strategy was developed to decentralize the examination processes at colleges/institutes, computer centre and examination branches level. The colleges/institutes has been strengthen by providing small software (utilities) to create databases of their students, easy management of term end and practical awards and send the same to the university for examination purposes. In addition to this, ICR technology is being used to minimize human intervention and enhance efficiency and productivity of overall system. The manually entered data as well as ICR converted data are collated to get cleaned data by removing discrepancies at the earlier stages. The university has also organized different workshops for the personnel of examination wing to enhance their awareness level and to provide them hands on skill upgradation trainings on different utilities. The decentralisations of examination processes, has been facilitating the university to save cost, minimize result preparation time, timely availability of information, reduce psychological pressure on employees and improve its public image.

III. SWOT ANALYSIS AND ITS USAGE

The SWOT analysis is a structured planning method used to evaluate the strengths, weaknesses, opportunities, and threats involved in a project. It can be carried out for a product, place, industry or person. It involves specifying the objective of the project and identifying the internal and external factors that are favourable and unfavourable to achieving those objectives [5]. The SWOT analysis provides information that is helpful in matching the firms' resources and capabilities to the competitive environment in which it operates and is therefore an important contribution to the strategic planning process [6]. The applications of SWOT analysis are not just limited to Management Sciences. The following researches show the usage of SWOT in Computer and IT Disciplines: 1) A Technical SWOT Analysis of ICT Facilities in the Jammu University, India [7], 2) Critical Analysis of an Information System for Community Nursing [8], 3) SWOT Analysis of Software Development Process Models [9], 4) A SWOT Analysis of Software for Agriculture in Poland [10], 5) SWOT Analysis of Software Quality Metrics For Global Software Development [11], SWOT Analysis of Computer Based Expert System [12], etc. The SWOT analysis organises information into two main categories: 1) internal factors-strengths and weaknesses internal to the organization, 2) external factors– opportunities and threats presented by the environment and external to the organization [5]. There is no system in this world which is immune to outside events and forces. The information system is influenced by the environmental and organisational factors. The environmental factors are the actions of the competitors, geographic sociocultural, political and economic factors and governmental regulations. The organisational factors include company goals, the existing structure, tools and technology, company policies and physical and financial resources [13]. For SWOT analysis, there is a need to separately identify strengths and weaknesses among internal factors, and opportunities and threats among external factors which influence the system [5]. A good SWOT analysis can facilitate to: 1) explore possibilities for new efforts or solutions to the problems, 2) make decisions about the best path for initiatives, 3) determine where change is possible specially at a turning point, an inventory of strengths and weaknesses can reveal priorities as well as possibilities [14]. In current paper, the existing computerised examination system needs certain changes to owing academic and examination reforms under NHEM (National Higher Education Mission) which may results in either modify the existing examination system or to go for new system. The system development system needs comprehensive planning good enough to handle the unforeseen events that inevitably occur in large projects. The economic, political and personnel factors should be taken into account for a realistic plan and thus for a successful project [15]. So to mitigate the risks of failure and to provide visionary sight for the university management before taking any final decision, it becomes essential to analyse available resources, existing system and external forces using SWOT analysis.

IV. RESEARCH DESIGN AND METHODOLOGIES

The SWOT analysis is more effective if input comes from many stakeholders. Each person or group offers a different perspective on the strengths and weaknesses and has different experiences of both [14]. So, a group of ten persons was formed consisting of different stakeholders- students of colleges, technical persons, officers and officials of examination branches. The members of the group were introduced about the SWOT method, its purpose and they were asked to identify strengths (s), weaknesses (w), opportunities (o) and threats (t) of existing computerised examination system with respect to internal and external factors. A preliminary raw list containing s, w, o and t obtained from the group. A final list containing of 14 strengths, 17 weaknesses, 7 opportunities and 6 threats was prepared after deliberate discussion. Thereafter, the group members were asked to assign an importance level to each strength & weakness and impact level for each opportunity & threat components of SWOT using 3 points Likert Scale. This exercise was followed by rating/scoring of the same components of SWOT on actual existing computerised system. The Table 1 shows the usage of 3 points Likert Scale used for rating of SWOT components.

TABLE 1
SWOT COMPONENTS AND CORRESPONDING IMPORTANCE/IMPACT AND RATING SCALES

Sr. No.	SWOT Components	3 Points Importance/ Impact Scale	3 Points Rating Scale
1.	Strengths	High Importance (3), Moderate Importance (2), Low Importance(1)	Major (3), Middle (2), Minor (1)
2.	Weaknesses	High Importance (3), Moderate Importance (2), Low Importance(1)	Major (3), Middle (2), Minor (1)
3.	Opportunities	High Impact (3), Moderate Impact (2), Low Impact (1)	High Probability (3), Modest Probability (2), Low Probability (1)
4.	Threats	High Impact (3), Moderate Impact (2), Low Impact (1)	High Probability (3), Modest Probability (2), Low Probability (1)

A weighted score was prepared by multiplying actual rated score with priority (importance and impact) values. To identify potential strengths, weaknesses, opportunities and threats, the quartile method was used on weighted score to consider items falling on or above upper quartile and ignoring those falling below lower quartile. A "TOWS Matrix" was also prepared by correlating opportunities and threats with strengths and weaknesses to exploit opportunities to enhance strengths, overcome weaknesses, protect against threats and mitigate weaknesses w.r.t. exiting system.

V. **RESULTS AND DISCUSSIONS**

The Table 2 shows the observed strengths, weaknesses, opportunities and threats of existing system.

TABLE 2
SWOT TABLE OF COMPUTERISED EXAMINATION SYSTEM

Strengths	Weaknesses
S1: In-house developed product "Integrated Examination System" where changes can be done locally.	**W1:** Enhanced data entry cost & processing time due to involvement of human intervention.
S2: Integrated ICR system to convert handwritten data into machine readable form.	**W2:** Usage of paper based examination forms resulting into getting of incomplete and incorrect examination details from students.
S3: Decentralisation of examination processes at colleges/institutes level by using various small software utilities.	**W3:** Risks of poor data quality due to human intervention at various stages.
S4: Integrated students' database.	**W4:** Migration of database (MS Access 2000) from software utilities into Oracle database.
S5: Delivery of accurate and reliable results within a specified time period.	**W5:** Absence of user-friendly interfaces for low level users to interact with computerised examination system.
S6: On-demand generation of various reports.	**W6:** Requirement of well skilled manpower for usage of ICR "AutoRec" system.
S7: Capable to manage huge volume of students of different streams.	**W7:** No team leader to control, direct and organise software team members.
S8: Potential to computerise other PG Classes (MAs) examinations after customisation of existing system.	**W8:** Contractual employment of core team members resulting into low morale to do creative works.
S9: Well qualified technical team of four programmers.	**W9:** Nonparticipation of examinations branches personnel directly in computerised compilation of results.
S10: Team has enough experience of system development and maintenance.	**W10:** Communication gaps between branches and software development team.
S11: Team has high confidence level to manage computerised examination systems.	**W11:** Involvement of team members in clerical works in addition to software development due to non-availability of supporting staff.
S12: Capability of team to train non-technical personnel.	**W12:** Non-verification of computer generated reports by the branches in proper manner.
S13: Dedicated computer centre equipped with computing facilities.	**W13:** No provision of training for core technical staff to enhance their professional skills.
S14: Own website "hpuniv.ac.in" to host exam related information.	**W14:** All computer systems in computer centre are not on Local area Network.
	W15: Availability ICR "AutoRec" system on just five machines.
	W16: Availability of just two ICR scanners.
	W17: Non-coverage of computing resources under Annual Maintenance Contract (AMC).

Opportunities	Threats
O1: Availability of modern, robust, secure and cost effective web enabled examination management systems in market.	**T1:** Implementation of academic and examination reforms under National Higher Education Mission from the academic session 2013-14. This includes semester system, Continuous Comprehensive Assessment (CCA) of a student during his study period, Choice Based Credit System (CBCS)- interdisciplinary courses, etc.
O2: Availability of National Knowledge Network (NKN) facility for university and its affiliated colleges/institutes for seamless flow of data on high bandwidth.	**T2:** Pressure of stakeholders for on demand delivery of services.
O3: Provision of financial supports by the State/Centre Governments under various schemes for implementation of eGovernance related projects.	**T3:** Long and complex process of procurement of new hardware and software.
O4: Supportive attitude of Department of Information Technology of Himachal Pradesh State Government to provide consultancy for procurement of automated solutions.	**T4:** Dependency on outsourced manpower for data entry of awards to compilation of results.
O5: Availability of computing facilities with internet connectivity in all affiliated colleges/institutes in Himachal Pradesh.	**T5:** Pressure of students' unions on existing system to get results of their favourites before declaration, acceptance of examination forms after due dates.
O6: Facility of dedicated network HIMSWAN (Himachal State Wide Area Network) for exchange of data between various government departments and university.	**T6:** Opposition of various employees' unions for automation and outsourcing of various examination activities.
O7: Increasing base of IT savvy users.	

The aim of advanced SWOT is to identify the most significant factors from all the items listed above and assign priority to each so that some conclusions make be drawn. The Table 3 shows the priorities (importance/impact) and rated score of SWOT components.

TABLE 3 : PRIORITIES AND RATED SCORES FOR SWOT COMPONENTS

Strengths	Strengths Score			Weaknesses	Weaknesses Score			Opportunities	Opportunities Score			Threats	Threats Score		
	ASPS	ASS	ASWS		AWPS	AWS	AWWS		AOPS	AOS	AWOS		ATPS	ATS	AWTS
S1	3.0	3.0	**9.0**	W1	3.0	2.8	**8.4**	O1	2.9	2.8	**8.1**	T1	3.0	3.0	**9.0**
S2	3.0	2.8	**8.4**	W2	3.0	3.0	**9.0**	O2	2.8	2.8	**7.8**	T2	3.0	3.0	**9.0**
S3	2.9	2.5	7.3	W3	3.0	2.8	**8.4**	O3	2.6	2.9	7.5	T3	2.4	2.6	6.2
S4	2.3	2.1	*4.8*	W4	3.0	3.0	**9.0**	O4	2.3	2.2	5.1	T4	3.0	3.0	**9.0**
S5	2.4	2.4	*5.8*	W5	2.7	2.5	6.8	O5	2.0	2.3	*4.6*	T5	1.9	2.6	4.9
S6	3.0	2.7	8.1	W6	2.9	3.0	**8.7**	O6	1.7	1.7	*2.9*	T6	1.1	2.6	*2.9*
S7	2.3	1.6	*3.7*	W7	3.0	3.0	**9.0**	O7	2.1	2.3	4.8				
S8	2.9	2.7	7.8	W8	3.0	3.0	**9.0**								
S9	3.0	2.8	**8.4**	W9	2.8	2.7	7.6								
S10	3.0	2.7	8.1	W10	2.9	2.6	7.5								
S11	2.8	2.9	8.1	W11	2.9	3.0	**8.7**								
S12	3.0	2.9	**8.7**	W12	2.8	2.6	7.3								
S13	2.6	1.7	*4.4*	W13	3.0	3.0	**9.0**								
S14	2.8	2.2	6.2	W14	3.0	3.0	**9.0**								
				W15	2.7	3.0	**8.1**								
				W16	2.7	3.0	**8.1**								
				W17	3.0	3.0	**9.0**								

 # ASPS- Average Strength Priority Score**, ASS-**Average Strength Score**, ASWS-** Average Strength Weighted Score**, AWPS-**Average Weakness Priority Score**, AWS-**Average Weakness Score**, AWWS-**Average Weakness Weighted Score**, AOPS-** Average Opportunity Priority Score**, AOS-**Average Opportunity Score**, AOWS-** Average Opportunity Weighted Score**, ATPS-** Average Threats Priority Score**, ATS-**Average Threats Score**, ATWS-** Average Threats Weighted Score

First, Second and Third Quartile Values for SWOT Components											
Strengths			Weaknesses			Opportunities			Threats		
Q1	Q2	Q3	Q1	Q2	Q3	Q1	Q2	Q3	Q1	Q2	Q3
5.9	8.0	8.3	6.7	7.3	7.8	4.7	5.1	7.7	5.3	7.6	9.0

#Q1- 1st Quartile, **Q2-**2nd Quartile and **Q3-** 3rd Quartile

It is observed that in-house development of software product, usage of ICR for minimisation of human intervention, well qualified technical manpower and their capability to train other employees are the potential strengths of existing system. The observed weaknesses in the existing system are: 1) involvement of human intervention for data entry jobs, 2) usage of paper based examination forms, 3) poor data quality, 4) migration of data from database to another, 5) requirement of skilled manpower, 6) no team leader to look after the overall examination system, 7) contractual deployment of manpower to manage examination system, 8) no provisions of skill development trainings for core technical staff, 9) inadequate availability of computing resources in computer centre, and 10) no provision of annual maintenance contract (AMC) to repair existing computing resources. The available potential opportunities in existing system are: 1) availability of state-of-the-art web enabled examination management systems in the market, and 2) availability of National Knowledge Network within the university and for affiliated colleges for fast information exchange. The potential threats are: 1) implementation of academic and examination reforms, 2) pressure of stakeholder for on demand delivery of services, and 3) long and complex process for procurement of computing resources and in meantime the technology become obsolete.

Once identified and prioritized SWOT results, there is a need to use them to develop short-term and long-term strategies for organisation. After all, the true value of this exercise is in using the results to maximize the positive influences and minimize the negative ones. One way to do this is to consider how strengths, weaknesses, opportunities, and threats overlap with each other. This is sometimes called a TOWS analysis. This is to use strengths to maximize the opportunities and minimize the threats. Continuing this process, use the opportunities to develop strategies that will minimize the weaknesses and avoid threats [16]. The Table 4 shows the correlation of opportunities & threats with strengths and weaknesses.

TABLE 4
CORRELATIONS OF OPPORTUNITIES AND THREATS WITH STRENGTHS AND WEAKNESSES

Opportunities and Strengths (O & S)	Opportunities and Weaknesses (O & W)
(O1, O2, O3, S3, S4, S5, S6) 1. Ripe time to implement web enabled computerised system to meet the emerging needs of all stakeholders- students, teachers, colleges and university, decentralisation, on demand availability of services, etc.	(O1, W1,W3) 1. Need to deploy web enabled students management system to get quality data from variable sources and minimise human intervention to reduce data entry and processing costs.
(O1, S3,S6, S7) 2. Provide role based users' interfaces in new system in a specified hierarchy: university-colleges-students, timely delivery of services, better control of examination activities, etc.	(O1, O2, O5,O6, W3,W4) 2. Need to have inbuilt provisions of data validation checks, input data ranges and mandatory fields in software to get good quality data.
(O4, S3, S4, S5, S6, S7) 3. Involve DIT to provide consultancy in designing /procurement of web enabled computerised system.	(O1, W5, W11, W12) 3. Need to provide user-friendly interfaces based on users' requirements and roles.
(O5, O6, S3, S5, S6) 4. Create students facilitator centres "Chhatra Mitra Kendras" at colleges' level to strengthen university, colleges and students relationships with on demand availability of IT enabled examination, registration and admission services through eGovernance.	(O1,O7, W7) 4. Need to deploy effective team head to control, organise and direct team members. (O1, W8) 5. Need to appoint existing team members on regular basis to provide them moral support, social security, etc.
(O3, S13) 5. Prepare proposals to seek financial grants from state/central governments for eGovernance in education sector.	(O1,O2, O3, O4, O5, O6, O7, W14, W15, W16, W17) 6. Need to strengthen existing computer centre by adding more computing power, network facility, latest software and skilled manpower.
(O1,O3, S9, S10, S11, S12, S13)	(O1, O2, O3, O4, O5, O6, O7, W8, W9, W10, W11,

	W12)
6. Organise skill development workshops for non-technical personnel for usages of software. (O1, O3, O4, S1, S9, S10, S11) 7. Need to involve core technical team in development and implementation of web enabled system. (Q3, S2) 8. Need to implement ICR technology to automate other manually managed processes like admission, registration & migration, etc. to reduce cost, save time, bring transparency & efficiency, enhance data quality & productivity, etc.	7. Need to reconstitute a software development team by involving potential personnel of dealing branches and clear segregation of responsibilities for technical and non-technical staff. (O1, W14,W15,W16,W17) 8. Need to have AMC for timely maintenance of computing resources in addition to add more ICR systems to minimize human intervention. (O1,O3, W13) 9. Need to have provisions of professional skill development training programmes for core technical staff to keep them update about latest available technology.
Threats and Strengths (T &S)	**Threats and Weaknesses (T & W)**
(T1, S1, S3) 1. The existing system is not compatible to implement academic and examination reforms under NHEM i.e. CBCS, CCA, semester mode, etc. It is better to go for new system because the old system has limited scalability to enhance. Further, existing technical manpower cannot devote time for building new system because they have to run old system for failure students. (T2, T6, S6) 2. The legacy system is catering the needs of only specific categories of users but keeping in view the emerging needs of different categories of users, there is a need to make provisions of availability of on demand services according to users' roles. (T1, T2, S10, S11, S12, S13, S14) 3. Need to have state-of-the-art technological solutions in the computer centre to meet the emerging needs of the stakeholders.. (T4, T6, S3, S12) 4. Need to involve concerned personnel of examination branches by strengthening them with user-friendly interfaces to do role based jobs. This will help to train existing manpower and mitigate the risks of dependency on outsourced manpower for highly confidential result compilation works.	(T1, T4, W1, W2, W3, W4) 1. High human interventions enhance cost, time, error prone data, low public image, etc. So minimise it. (T4, T6, W5, W6) 2. Absence of user-friendly interfaces for low level users has the risks of non-acceptability of computerised system among them. (T4, W9, W12) 3. High dependency on outsourced manpower for data entry works has risks to breach examinations results confidentiality. (T1, W13, W14, W15, W16, W17) 4. The implementation of academic, examination reforms will be a failure if computer centre is not strengthen by adding skilled technical manpower, commuting resources, AMC, etc. (T1, W2, W6, W11, W13) 5. Need of additional technical manpower because the existing manpower is already engaged to deal with legacy system for failure/old candidates. Need to seek help from DIT for development/procurement of new system. (T1, W14,W15,W16,W17) 6. Need financial assistance to strengthen eGovernance services in university system.

VI. CONCLUSIONS

The management plays very important role to make a system successful and the SWOT analysis is a potential tool to critically evaluate the existing system by identifying its strengths, weaknesses, opportunities and threats within and outside the system. The obtained results using SWOT can be refined further for effective decision-making process by setting priorities to them and identification of potential sea-changing agents followed by correlating opportunities and threats with strengths and weaknesses using TOWS matrix. This can facilitate to optimise opportunities to enhance strengths, minimise weaknesses and avoid threats. The use of SWOT is not just limited to management sciences but can be used effectively in evaluation of existing automated systems, development of new information systems and their implantation in a specific environment. But this needs a proper planning and care to identify potential SWOT components and rich correlations among them. The oversight and limited vision of university's authority may hamper the usage and implementation of ICT applications to bring academic and examination reforms under new system. There is a need to realise that the ICT is just a tool not a magical stick and cannot change the real world within minutes. There is a need of proper planning, continuous evaluation of resources, potential opportunities and threats within the environment, proper monitoring & feedback system, motivated and dedicated manpower having potential to change.

Matters of Himachal Pradesh University, Shimla, India for motivating towards writing research papers on automation of examination system.

REFERENCES

[1] (2013) University Automating Exam System, The Hindu Newspaper Website. [Online]. Available: http://www.thehindu.com/features/education/college-and-university/university-automating-exam-system/article5436728.ece

[2] (2013) Rashtriya Uchchtar Shiksha Abhiyan. National Higher Education Mission, Ministry of Human Resource Development. Government of India. [Online]. Available: http://mhrd.gov.in/sites/upload_files/mhrd/files/RUSA_final090913.pdf

[3] Amar Jeet Singh and Mohini Bhardwaj. (2008) E-Governance: Single Portal for Integrated Examination System. [Online]. Available: www.csi-sigegov.org/ emerging_pdf/31_287-293.pdf

[4] Ramez Elmarsi and Shamkant B. Navathe, *Fundamentals of Database Systems,* 5th ed., Delhi: Pearson Education, 2008.

[5] (2014) SWOT Analysis. Wikipedia website [Online]. Available: http://en.wikipedia.org/wiki/SWOT_analysis

[6] (2005) SWOT (Strengths Weaknesses Opportunities and Threats) Analysis. European Commission - JRC – IPTS. [Online]. Available: http://forlearn.jrc.ec.europa.eu/guide/4_methodology/meth_swot-analysis.htm

[7] Amit Mahajan and Dhirendra Sharma. (2012) A Technical SWOT Analysis of ICT Facilities: Jammu University, Jammu, India. International Journal of Advanced Research in Computer Science and Software Engineering. Vol 2(12). [Online]. Available: http://www.ijarcsse.com/docs/papers/12_December2012/Volume_2_issue_12_December2012/V2I11-0215.pdf

[8] Iztok Bitenc, et. al. (2000) Critical Analysis of an Information System for Community Nursing. [Online]. Available: http://is2.lse.ac.uk/asp/aspecis/20000145.pdf

[9] Ashish B. Sasankar and Vinay Chavan. (2011) SWOT Analysis of Software Development Process Models. International Journal of Computer Science Issues. Vol. 8(5.3). [Online]. Available: http://ijcsi.org/papers/IJCSI-8-5-3-390-399.pdf

[10] Karol Wajszczuk and Jacek Wawrzynowicz, (2013) A SWOT analysis of software for agriculture in Poland. [Online]. Available: http://agrimba2013.me/files/sessions/session15/karol.pdf

[11] Sadia Rehman and Siffat Ullah Khan. (2012) SWOT Analysis of Software Quality Metrics for Global Software Development: A Systematic Literature Review Protocol. IOSR Journal of Computer Engineering (IOSRJCE). Vol. 2(1). (July-Aug. 2012), PP 01-07. [Online]. Available: http://iosrjournals.org/iosr-jce/full-issue/vol2-issue1.pdf

[12] N. Balasubramani et al. (2007) SWOT Analysis of Computer Based Expert System on –RUBEXs 04. Research Journal of Orissa Agriculture University. 25(1). [Online]. Available: http://eprints.cmfri.org.in/9583/1/swathilakshmi_Journal_of_Research.pdf

[13] Elis M. Awad, *System Analysis and Design*, 2nd ed., New Delhi: Galgotia Publications Pvt. Ltd., 2010.

[14] Val Renault. (2013) SWOT Analysis: Strengths, Weaknesses, Opportunities, and Threats. University of Kansas. [Online]. Available: http://ctb.ku.edu/en/table-of-contents/assessment/assessing-community-needs-and-resources/swot-analysis/main

[15] Pankaj Jalote, *An Integrated Approach to Software Engineering*, 2nd ed., New Delhi: Narosa Publishing House, 2001.

[16] Tim Berry. (2014) What is a SWOT Analysis? [Online]. Available: http://articles.bplans.com/business/how-to-perform-swot-analysis/116