A Framework for Vice Chancellors to Increase the International Rankings of Universities through Effective Decision Making Based on KPIs via Visual Digital Dashboard

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Abstract

There are global university rankings of higher educational institutions. Public and private universities around the world endeavour to improve their rankings and to be at the top of the ranking lists. These rankings help students in finding out prominent universities for getting admitted, and after graduation in a better job placement. There are significant key performance indicators (KPIs) to determine these rankings. These KPIs are based on data, knowledge and information of a university (higher education institution [HEI]). Effective decision making through these KPIs improve the ranking and performance of the university. Business intelligence (BI) software for educational institutions is dedicated towards the provision of solutions for decision making. Therefore, the BI software might improve academic performance. However, literature reveals that the failure rate of BI projects is between 70% to 80%. In addition, they are costly solutions and require a huge amount of time for implementation. Hence, there is a need to find alternate solutions for better decision making that is economical and time efficient. An improvement in performance means improvement in the ranking of the university that is centred on better decision making, focusing on the significant KPIs, such as KPIs used by the Times Higher Education for world's university rankings and QS university rankings. This paper offers a framework of decision making through a visual digital dashboard for the vice chancellors (heads or presidents) of higher education institutions, based on a formal working structure of a university. Moreover, this framework focuses on policies and procedures linked to specific KPIs of the university and the impacts of these policies or procedures on these KPIs. Visual digital dashboard provides the statistics through comparison reports, flowcharts, graphs and trends. Effective decisions could be taken to improve the performance of an underperforming KPI; if there is a need of improvement for the KPI, a revision(s) is recommended in the policy or linked procedure(s) of that KPI, and the impact of revision(s) is measured again through the visual digital dashboard of decision making. These revisions of policies or procedures linked to any KPI is a continuous process until an expected outcome is achieved. According to the framework, some departments of the university play a vital role in the implementation and revisions of these policies or procedures. This framework is termed as VCDBDM (Vice Chancellor's Dashboard of Decision Making) framework that offers a visual digital dashboard as a decision support system to the vice chancellors (VCs)/heads/presidents of the universities. Altogether, the offered framework of VCDBDM provides an opening to the universities of Oman, GCC countries, MENA region, and worldwide universities concerning its application for successful decision making and improvements in the performances and rankings of the universities.

Keywords: *Decision Support System, Effective Decisions, KPIs, Policies and Procedures, Ranking of Universities, Revisions, Vice Chancellor, Visual Digital Dashboard*

1. Introduction

There is a global competition of rankings among worldwide universities, and public and private universities want to be at the top of these rankings lists. These lists are based on some key performance indicators. Whenever a new ranking list gets published, a university might climb up, down, debut, get excluded or stay at the same position. These rankings are announcements about esteemed educational institutions those attract students and worldwide employers. Generally, this is the wish of every competing university to climb up the rankings, as compared to its previous position. The improvement in ranking requires better performance centered on different performance indicators. Digital transformation converts the manual processes of an organization to computer based digital data that can help in analyses and historical comparisons for better decisions towards the improvement in performance.

Business intelligence software deals with methodical infrastructure to gather, save and compare the data of an organization [1]. Proper arrangement of data, knowledge and information leads towards intelligence and is the base of effective decision making. BI software is used in different fields of life, like business, medicine and education. It stores, retrieves, structures, explores and analyzes the data, provides a dashboard that generates reports, graphs, flowcharts, queries and offers many other decision making items those are used to make improved and healthier decisions. There are well known companies in the market those are offering complete BI solutions for education, such as Oracle and NetSuite.

However, literature reveals that the success rate of BI systems is very low [2], cost effective and requires enormous time for the implementation [3]; moreover, BI systems do not provide required actions as an input for the future requirements those lead towards continuous improvements [4].

Hence, there is a need to provide solutions towards the production of effective improvements within practical environments of educational organizations those lead towards effective decision making with guided actions keeping in view future requirements of organizations, without relying on the business intelligence systems. In addition, it is universally known that human intelligence is superior and does not have any comparison with artificial intelligence.

This paper focuses on the process of effective decision making through an offered framework that is based on revision(s) of a policy (policies) or/and procedure(s), linked to the key performance indicators those are required to improve the international ranking of a public or private university. This framework is named as VCDBDM (Vice Chancellor's Dashboard of Decision Making) that involves all the departments and key stakeholders linked to the university, including: staff, learners, policy makers, researchers, parents, connected industries with educational areas, experts and alumni. VCDBDM requests 'central information system department' plus 'central educational technology department (that works with educational technology, or might operate a Learning Management System)' of the university to produce the information for the decision support system through visual digital decision dashboard (figure 4). They can produce the dashboard through well-known tools of reporting such as 'Tableau', 'Crystal Reports', or machine learning programs like 'Google cloud AI platform' and 'Azure machine learning' for future predictions. Based on the underperforming KPIs, available through the visual digital dashboard of the VCDBDM framework, a vice chancellor/head/president of the university makes decisions, and the process of revision(s) on the policy (policies) or/and procedure(s) linked to these KPIs gets started. The vice chancellor checks the impacts of revision(s) on the targeted KPIs via visual decision dashboard for the next cycle of expected outcomes. Therefore, these revisions work towards the improvement of

KPIs; consequently, performance outcomes get improved and the ranking of the university climbs up at worldwide levels.

This framework is a continual process of revision(s) for a policy (policies) or/and procedure(s), if required to improve the performance of an underperforming KPI(s), extracted from the visual digital dashboard towards continual improvement. According to the VCDBDM framework there are five major departments of a university those play a vital role in the revision(s) of the policy (policies) or procedure(s) and report generations of main KPIs. Next sections of this paper are connected with 'Literature Review', 'Independent, Dependent and Moderating Variables of the Framework', 'VCDBDM (Vice Chancellor's Dashboard of Decision Making)', 'Conclusions' and 'References'.

2. Literature Review

2.1. Data, Information, Knowledge and Intelligence

Data is defined as facts creating the source of reasoning and calculation that is gathered for analysis and conclusions [5]. Ordered and structured data is information [6]. Knowledge is ordered and structured information that is implicit and retained by an individual; moreover, knowledge is identified facts achieved through experience, participation, contribution or practice [7, 8]. Intelligence is the knowledge that is an outcome of investigation, classification and analysis [28]. Technology plays a vital role towards the process of knowledge sharing [9]. Artificial intelligence is a system of computer programs established through machines that mimics or simulates human intelligence and works on algorithms [30]. The relationship among data, information, knowledge and intelligence can be seen in figure 1 [10].
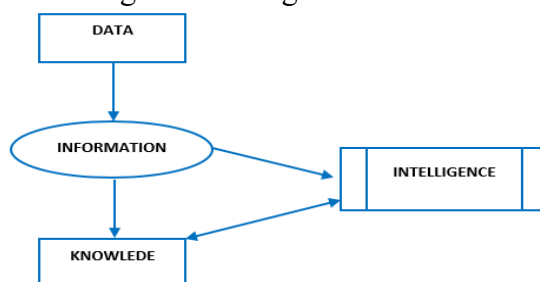

Figure 1. Data, information, knowledge and intelligence - Source: [10]

2.2. Decision Support and Business Intelligence (BI)

Decision support was a technology in 1950 that had developed the notion of Business Intelligence [11]. Big data analyses consist of business intelligence, data mining and explorative features. Therefore, business intelligence is a subcategory of big data analytics that is a collection of information through different processes, its structuring, organization and comparison to take productive decisions [12]. Business intelligence helps organizations to compare and evaluate business related data towards making effective decisions [12, 13]. Business intelligence is a system that supports decision making; moreover, it allows huge amounts of information gathering, manages unstructured and structured data and provides enhanced and enriched capabilities [1]. Business intelligence system is based on a blend of technologies, where a data warehouse collects significant and accurate information from different areas, online evaluations help in comparisons, and a dashboard is a helpful feature with graphs and illustrations for observations and decision making [14]. An isolated set or group of data that is hard to obtain, integrate, or utilize with other data of an organization is called a data silo [29]. Oracle, NetSuite and Salesforce are famous organizations those are

offering BI solutions as software as a service (SaaS) for education. There are different methods of BI software deployment: (i) Cloud computing. (ii) On-Premise instalment. (iii) SaaS hosted on demand [15].

However, [3] claims that the price to implement and execute a BI system is huge and time consuming; in addition, data mining and other tools require supplementary training and might require outsourcing the operations to a third party, like field experts. A technological research firm 'Gartner' claims that the failure rate of business intelligence projects is between 70% to 80% [2]. One of the issues with many business intelligence systems is that these systems work on data and provide illustrations, graphs and reports without driving any guided actions towards future requirements; moreover, BI is treated as a single-time project [4]. A survey conducted by [16] has declared that eighty seven percent of organizations are under low business intelligence and analytical maturity. Gartner stated that through the year 2022, only twenty percent of analytical insights would provide business outcomes [17]. As mentioned above, BI systems have lower success rates, are expensive, time consuming and do not drive guided actions for future needs like human intelligence; therefore, there are a lot of issues with BI systems in helping higher educational institutions towards the improvements of performances and rankings. Consequently, solutions are required to produce effective improvements through effective decisions making with guided actions as inputs extracted from outcomes, without depending on the business intelligence systems.

2.3. What is a Business Intelligence Data Dashboard?

A business intelligence data dashboard is used to track, compare and present key performance indicators to the top management of an organization for making decisions, keeping in view the evaluations and comparisons. Therefore, a power BI dashboards exhibits significant decision making specifics [18]. Software like Crystal reports, Tableau, Power BI and Jasper reports are well known data visualisation tools used to create reports based on the data of an organization; these reporting tools can produce reports, flowcharts, graphs and other items for visual digital dashboards. These tools can break down data silos and streamline to support the data, and have the capability to get connected with different data sources; Tableau tool can be connected to a range of data sources like Excel and comma-separated values files, relational database systems like SQL Server, Oracle Database, DB2 Database, Google Sheets, Google Cloud SQL and many other data sources [31].

2.4. What is a Report?

A report is detailed information shown in different arrangements such as illustrations, charts, tabular and graphical information based on available data; moreover, a report may be created on a single dataset [19].

2.5. What is Machine Learning?

Machine learning is a technique that uses algorithms to evaluate and compare the existing information for future predictions [20]. Machine learning provides precise predictions based on existing data [21]. Google cloud AI platform and Azure machine learning are the examples of famous machine learning platforms.

2.6. Stakeholders of an Educational System

Main key stakeholders of an educational system are policy makers, teachers, learners, managerial heads of pedagogical organizations, parents, researchers and industries connected with the educational areas [22]. Figure 2 shows the key stakeholders of an educational system.

Figure 2. Key stakeholders of an educational system.

2.7. Key Performance Indicators Required for a Higher Education Institution for Performance Comparison and Improvement of Performance Ranking at Global Level

Key performance indicators are the cores of decision making. Overall there are a number of key performance indicators those are used to compare the performance of an educational institution; however, there are following five major key performance indicators those are genuinely important as the core of indicators [23]:

1) Achievement of learners. 2) Discipline referrals. 3) Learning classroom attendance percentage. 4) Percentage of learners' graduation. 5) Satisfaction of instructors.

The Times Higher Education (THE) provides World's University Rankings. Following are some of key performance indicators on the basis of which THE provides global rankings of the universities [24]:

Teaching: 1) Staff to student ratio. 2) Institutional income. 3) Number of full time enrolled students. 4) Male and female students' ratio. 5) PhDs awarded to academic staff ratio. 6) Doctorate to bachelor's ratio. *Research:* 7) Research Income (if any). 8) Research productivity (number of papers per researcher). 9) Citations per paper. *International Outlook:* 10) International to domestic students' ratio. 11) International to domestic staff ratio. 12) International collaborations. *Industry:* 13) Industry Income (knowledge transfer). 'California Institute of Technology' was in 4th position (overall score: 94.5) according to the World University Ranking of THE during 2021 [32], and climbed two positions up to 2nd position (overall score: 95.0) in 2022 [33] on the basis of these KPIs; likewise, 'Harvard University' in THE ranking climbed one position up, from 3rd (overall score: 94.8) in 2021 [32] to 2nd (overall score: 95) in 2022 [33], using these KPIs.

The QS world university rankings for Arab and other regions count on following key performance indicators [25]:

1) Citations per paper. 2) Papers per faculty. 3) International Research Network. 4) Number of faculty staff with PhDs. 5) Ranking of Programs (Academic Reputation): Arts and

Humanities, Engineering, Medicine and others. 6) Faculty Student Ratio. 7) International Faculty Ratio. 8) International Students Ratio. 9) Employer Reputation.

Some of the following are supportive key performance indicators those are counted under common knowledge and needed by any university (higher education institution) for performance improvement:

Teaching and Learning: a) Overall students' performance (CGPA) for each department of all schools/colleges of the HEI. b) Overall average CGPA of the HEI. c) Overall comparisons of CGPA with previous terms/semesters/years. d) Students retention rates. e) Students drop out rates. f) Average CGPA of graduates. g) Other comparison charts as per requirements of the HEI. h) Teacher to student ratio of schools/colleges and departments. i) Average teaching load per instructor for each department, units, schools/colleges and the HEI. j). Self-evaluation reports. k). Inclusive education plans. l) Staff satisfaction with offered services by the HEI. m) Staff satisfaction with teaching and learning. n) Students' satisfaction with offered services by the HEI. o) Student satisfaction with teaching and learning. ***Research:*** a) Papers published in peer reviewed journals per department or school/college. b) Papers presented at international conferences. c) Books published by each department or school/college. d) Book chapters. e) Technical reports. f) Research projects funded by the HEI. g) Research projects funded by external sources. h) Comparative analyses of research (journal papers, conference presentations, books, book chapters and others) with previous years for each department and each school/college of HEI. i) Summaries and comparisons of community services information, like research based editorial services, faculty holding honorary positions, such as journal editors, associated editors, reviewers, conference session chairs, moderators, memberships of boards and international committees, guest lectures, keynote speakers, patent registrations, letters to editors and others. ***International collaborations:*** a) MOUs or agreements with other organizations. b) Memberships in international societies, groups or communities. ***Library:*** a) Number of books available, and issued per term/semester/year. b) Papers/books/articles read through the digital library by students and staff. ***Strategic Plan:*** a). Status of Strategic Plan with implementations. ***Benchmarking:*** a). Local and regional benchmarking. b) International benchmarking. ***Risk Management:*** a) Mitigation plans/trainings/events. ***Human Resource. Hospital. Legal Affairs & Security. Parents Feedback. Research Questions and Solutions by Researchers. Industries Feedback about Programs. Health Services. Internal and External Audits. Housing/Stores/Maintenance/PR/Procurement and others.***

2.8. Policies and Procedures

A policy is a course of action, standard, set of rules or high-level statement for an act approved or recommended by an institution or authority that needs to be followed by concerned stakeholders to attain a specific goal, and that answers the queries regarding what stakeholders do and why they do [26]. A procedure is an official approach, instruction, a method or system on how a policy is followed or accomplished step-by-step; hence, it is a sequence of steps taken in a specific mode [26]. Policies and procedures contribute towards the provision of guidelines, steps and directions to perform different operations and guarantee compliance with the stated laws leading towards decision-making and restructuring of in-house practices [26]. When a policy does not return expected outcomes of improvement then risk gets increased; that is the time to review the policy or related procedure(s), and this revision brings improved performance that leads towards better decision making [27].

3. Independent, Dependent and Moderating Variables of the Framework

According to the literature review, following are dependent, moderating and independent variables of VCDBDM framework of decision support system, as shown in figure 3 for the university (HEI).
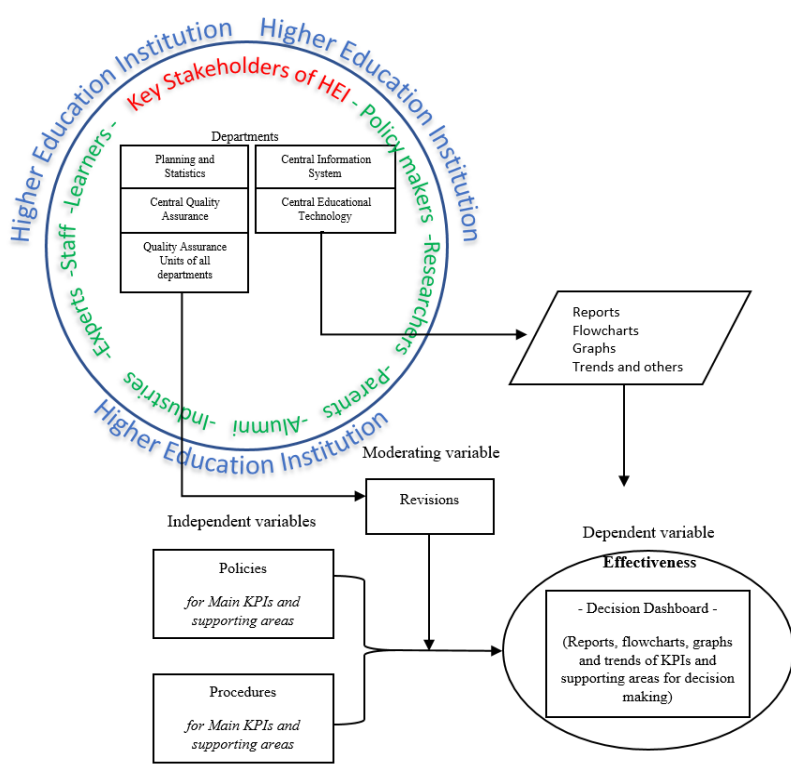
Figure 3. Dependent, moderating and independent variables of VCDBDM framework

Figure 3 reveals that 'effectiveness' of the visual decision dashboard is a dependent variable; 'polices' and 'procedures' are independent variables and 'revisions' of policies or procedures is a moderating variable.

4. VCDBDM (Vice Chancellor's Dashboard of Decision Making) Framework

Keeping in view dependent, moderating and independent variables, figure 4, shown on the next page demonstrates the complete framework within a university. The departments of 'statistics and planning', 'central quality assurance', 'central information system', 'educational technology that deals with educational technology or a LMS' and 'quality assurance units of HEI's departments' are highlighted in blue colour those play central role towards the provision of reports for visual digital decision making dashboard, implementation and revision(s) of a policy (policies) or/and procedure(s) or both. Therefore, all the links highlighted in blue colour perform an important role for the VCDBDM framework that is a continual process of revision(s) towards comparisons and evaluations of KPIs concerning better decision making for improvements, until expected outcomes get attained. All the other colours with dotted and dashed lines and arrows are shown to establish internal connections among different departments of the university.

There are eight different tabs of the VCDBDM (figure 4), based on significant titles of KPIs, including: "Teaching and Learning", "Research", "International Outlook", "Industry", "Budget", "Programs", "Benchmarking" and "Supporting Areas". All these tabs have further details of linked KPIs as shown at the left and right sides of figure 5.

There are two types of policies used by any HEI; the first type is developed by policy makers and the second type is by the HEI.

Following is an example of revision for a policy or/and procedure(s) through the VCDBDM framework.

Policy: A program of study offers 450 credit hours in a year through three courses at a university.

(Let us say there are X, Y and Z courses in the program.)

Procedures:
- Each course has to take a total of 150 credit hours in a year.
- Each course has to take 75 credit hours of theory in classrooms.
- Each course has to take 75 credit hours in laboratories.

After going through local and international benchmarking reports on programs of studies through the visual digital dashboard of decision making (VCDBDM), a vice chancellor takes the decision to improve the international ranking of the program of study. It is discovered by the 'strategic planning' + 'central quality assurance' + 'quality assurance unit of the program's department' that the performance improvement of this program needs additional practical skills in all the areas; because students attend all the courses of this program in two parts (theoretical and practical). They find through literature that students forget an average of 70% information in 24 hours, therefore, students face difficulty when applying the theoretical knowledge in the laboratories during other days. Therefore, there is a need for revisions on the procedures.

Revised procedures
- Each course has to take a total of 150 credit hours in a year.
- Each course has to take all 150 hours of theory and practical in laboratories.
- Instructors have to adjust the courses according to the current revisions (revise the course contents for the theory and its practical application in the laboratory during the same lecture).

After this revision, reports of the next cycle through the visual digital dashboard of decision support system tell about the impacts of change on the program's performance. If still there is no improvement, this might be a time to revise the policy. There are two types of policies; the first type comes under the jurisdiction of the VC that could be directly revised, and the second type comes under the authority of the policy makers. This revision might come under the policy makers. Therefore, the VC could request an approval of the policy revision from the policy makers and gets a sanction to add a fourth course in the program. The revision could be as following:

Revised policy: The program of study will offer 600 credit hours in a year through four courses.

(Now there are W, X, Y and Z courses in the program.)

Procedures (are same):
- Each course has to take a total of 150 credit hours in a year.
- Each course has to take 150 hours of theory and practical in laboratories.

Therefore, performance improvement is a continual process of revision(s) based on a policy (policies) or/and procedure(s) or both, until expected outcomes are achieved.

This framework (figure 4) has used general names of designations and departments in a university; there might be different names of designations or departments in other universities. There could be two or three departments merged into a single department; or a single department could be divided into multiple departments. Overall, the operational framework of every university is almost similar in relation to the offered framework. A university that wants to apply this framework of VCDBDM could replace the names of its designations and departments, and merge or split the departments according to its structure.
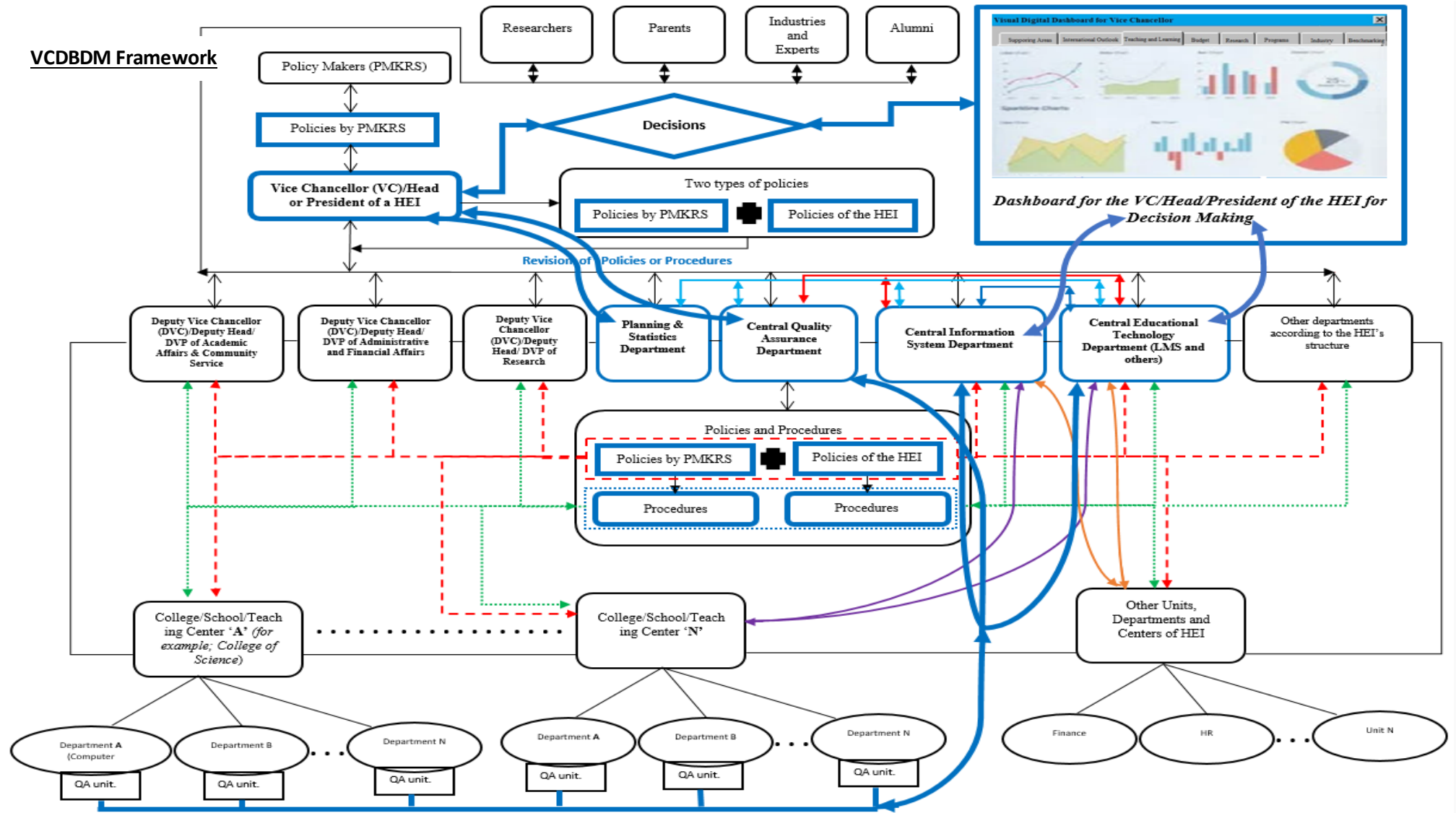
Figure 4. VCDBDM (Vice Chancellor's Dashboard of Decision Making) framework for a university (HEI)

Dashboard for the VC/Head/President of the HEI for Decision Making

Reports of Main KPIs   **Reports of Supporing areas**

KPIs for the improvement of ranking and performance of the HEI

Reports, flowcharts, graphs and trends of each department, unit and school/college of the HEI, including comparisons, historical analysis, percentages, averages, maximum, minimum, count, total, surveys feedback and others for the following KPIs:

Teaching and Learning
- Achievement of learners.
- Discipline referrals.
- Learning classroom attendance percentage.
- Percentage of learners' graduation.
- Satisfaction of instructors.
- Staff to student ratio.
- Number of full time enrolled students.
- Male and female students' ratio.
- Number of staff with PhDs.
- PhDs awarded to academic staff ratio (if any).
- Doctorate to bachelor's ratio.

Research:
- Research Income (if any).
- Research productivity – conferences and journals (papers per researcher or faculty).
- Citations per paper. Citations per faculty.

International Outlook:
- International to domestic students' ratio.
- International to domestic staff ratio.
- International collaborations or research network.

Industry:
- Industry Income (knowledge transfer).
- Employer reputation survey.

Budget
- Budget allocations
- Institutional income.

Programs:
- Current and previous rankings of all the programs (academic reputation): like Arts and Humanities, Engineering, Medicine, Science and others.
- Overall international outlook.

Benchmarking:
- Local and regional benchmarking.
- International benchmarking.

-Detailed Dashboard-
Provided to the Vice Chancellor
(A separate view of details through tabs for each title of the KPI.) Dashboard items are provided by Central Information System and Central Educational Technology departments of the university, according to the framework given in figure 4. These departments provide tabs for each title of the KPI, along with further details linked to the bulleted items (shown at the left side), as follows: 'Teaching and learning', 'Research', 'International Outlook', 'Industry', 'Budget', 'Programs' and 'Benchmarking'; as shown in tabs of visual digital dashboard in figures 4 and 5, plus tab of supporting areas (for the areas shown at the right side).

Reports, flowcharts, graphs, trends and other items could be produced from related data sets of the KPIs or from data silos - through Crystal Reports, Jasper Reports, Tableau, Power BI or any other program.

Future predictions could be provided through Azure Machine Learning platform or by any other software.

Reports, flowcharts, graphs and trends of each department, unit and school/college of HEI, including comparisons, historical analysis, percentages, averages, maximum, minimum, count, total, surveys feedback and others for the following supporting areas:

Teaching and learning:
- Overall students' performance (CGPA) for each department of all the schools/colleges of the HEI.
- Overall average CGPA of the HEI.
- Overall comparisons of CGPA with previous terms/semesters/years.
- Students' retention rates.
- Students drop out rates.
- Average CGPA of graduates.
- Average teaching load per instructor for each department, units, schools/colleges.
- Accreditation of programs.
- Academic program review and self-evaluation reports.
- Inclusive education plan's implementation
- Staff satisfaction with offered services by the HEI.
- Staff satisfaction with teaching and learning.
- Students' satisfaction with offered services by the HEI.
- Student satisfaction with teaching and learning.

Strategic Plan:
- Status of strategic plan's implementation.

Budget:
- Budget heads/allocations.
- Budget lapse.
- Budget deficit.

Risk Management:
- Mitigation plans/trainings/events.

Library:
- Number of books available, and issued per term/semester/year.
- Papers/books/articles read through digital library by students.
- Papers/books/articles read through digital library by staff.

Research:
- Papers published in peer reviewed journals per department.
- Papers presented at international conferences.
- Books publication by each department and school/college.
- Book chapters.
- Technical reports.
- Research projects funded by the university.
- Research projects funded by external sources.
- Comparative analysis of research (journal papers, conference presentations, books, book chapters and others) with previous years for each department and each school/college of the HEI.
- Community services information: research based editorial services, faculty holding the honorary positions, such as journal editors, associate editors and reviewers. Conference session chairs, moderators, memberships of boards and international committees, guest lectures, keynote speakers, patent registrations, letters to editors and others.

International collaborations:
- MOUs or agreements with other organizations.
- Memberships in international societies, groups or communities.

Extra-Curricular Activities:
- Plans, events and others.

HR.
Hospital.
Legal Affairs/matters & Security.
Parents' Feedback.
Research Questions and Solutions by Researchers.
Industries Feedback about Programs.
Health Services.
Internal Audits and External Audits.
Housing/Stores/Maintenance/PR/Procurement
Any other report…as per the requirements of the university.

Continual revision(s) of the policy (policies) or/and procedure(s) or both (if required) on the basis of visual digital dashboard information

Continual revision(s) of the policy (policies) or/and procedure(s) or both (if required) on the basis of visual digital dashboard information.

-Decision Making-
Continual revision(s) of university's policy (policies) or/and procedure(s) connected with main KPIs or supporting areas by the 'Central Quality Assurance Department' along with 'Planning and Statistics Department' and 'QA Units of departments' (if required to improve the performance or advancement towards expected outcomes) of higher education institution according to the structure given in figure 4. After revision(s), the next cycle is comparison of outcomes of reviewed policy (policies) or/and procedure(s) or both. The Vice Chancellor might send recommendations to the policy makers for the policy revision(s), or ask for further revision(s) of the policy (policies) or/and procedure(s) at the university through the staff of concerned departments (figure 4); it is a continual process of improvement and decision making through involving all the key stakeholders, including: 'Staff', 'Learners', 'Parents', 'Researchers', 'Experts', 'Alumni' and 'Industry', until expected outcomes get attained.
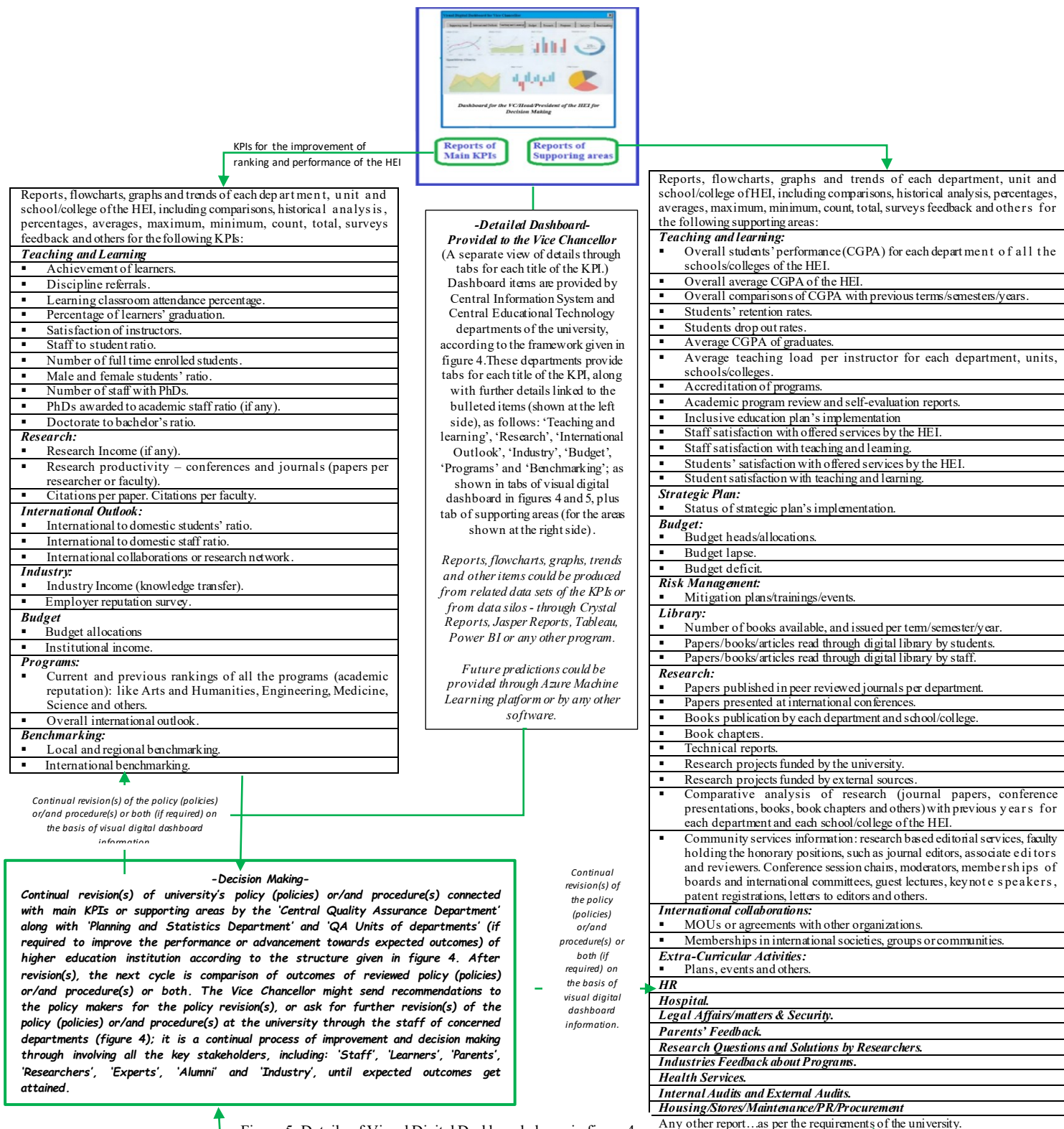
Figure 5. Details of Visual Digital Dashboard shown in figure 4.

Keeping in view the literature, figure 5 shows the details of the visual digital dashboard of decision making (VCDBDM) through significant KPIs at the left side those are required for better decision making towards the improvement of ranking and performance of the university, under the tab titles of 'Teaching and Learning', 'Research', 'International Outlook', 'Industry', 'Budget', 'Programs' and 'Benchmarking'; these tab titles open further details of linked KPIs under each title shown at the left side. In addition, right side of the figure 5 shows the supporting areas under the tab title of 'Supporting Areas' for the detailed KPIs of 'Teaching and Learning', 'Strategic Plan', 'Budget', 'Risk Management', 'Library', 'Research', 'International Collaborations', 'Extra-Curricular Activities', 'HR', 'Hospital', 'Legal Affairs/Matters & Security', 'Parents' Feedback', 'Research Questions and Solutions by Researchers', 'Industries Feedback about Programs', 'Health Services', 'Internal Audits and External Audits', 'Housing/Stores/Maintenance/PR/Procurement' and 'Any other reports as per the requirement of the university'. Moreover, in the center of the figure 5 there are details of the visual digital dashboard of decision making ('Detailed Dashboard'). Additional KPIs could be added to this framework (if required); and given KPIs could be increased or decreased from left to right side or vice versa according to the requirements of any university. 'Decision Making' box in the figure shows the process of decision making.

5. Conclusions and Future Work

The worldwide rankings of universities can support a student to find out a prestigious higher education institution for the enrolment. Graduates of top ranked universities have great opportunities of getting hired by prominent and famous organizations. Employers are typically convinced in employing the graduates of high ranked universities because of the reputation of educational institutions and anticipated skills and knowledge of their graduates those can add value to the organizations and become an asset at later stages.

These rankings are based on the comparisons of certain key performance indicators of higher educational institutions. These KPIs can be improved through better decision making. An effective decision making needs analyses and comparisons of KPIs in different formats; keeping in view the historical data, analyses and comparisons, a vice chancellor/head/president of a public or private university can take effective decisions. Business intelligence systems are counted for the provision of information for decision making; however, literature reveals that the success rate of BI systems is between 20% to 30%, implementation is time consuming and expensive. Human involvement and intelligence is required for effective revisions of underperforming KPIs for better decisions that lead towards improvement in ranking and performance of the university. Therefore, there is a dire need of solutions towards effective decision making, centred on existing operational setups of the universities through advancements of underperforming KPIs for rankings and performances improvements.

The presented framework of VCDBDM (Vice Chancellor's Dashboard of Decision Making) is a decision support system that is dedicated towards the provision of an effective solution to impact the efficacy of decision making in a positive direction. According to the framework, 'effectiveness' of the visual digital dashboard of decision making is a dependent variable, whereas, policies and procedures are independent and 'revisions' of policies or/and procedures is a moderating variable as shown in figures 3 of section 3. The operational mode of the VCDBDM framework is a repetitive process of revision(s) for a policy (policies) or/and procedure(s) or both towards analyses and comparisons of specific underperforming key performance indicators. If the outcomes of an underperforming KPI meet expectations, then there is no need for further revision(s). Conversely, a vice chancellor/head/president of the

university can make a decision of revision(s) for the policy (policies) or/and procedure(s) or both for an underperforming KPI; the outcomes are tested again in comparison to the projected outcomes of improvement. Therefore, it is a continuous process until expected outcomes of a KPI get achieved that results in an improvement of performance and ranking of the university. The working mode of the VCDBDM framework is in agreement with [26] that policies and procedures provide directions to complete multiple tasks and lead towards decision making. Decision making is based on key performance indicators. Moreover, if a policy does not come up with better results then the risk of future improvements gets involved; this is the right time to revise the policy or related procedures, subsequently, this revision comes up with better performance and effective decision making [27]. There are two types of policies; the first type is under direct authority of the VC and the second type is under control of the policy makers. Therefore, the VC could directly revise a policy under jurisdiction or send recommendations to the policy makers to revise the policy of an underperforming KPI using VCDBDM framework.

Therefore, the framework of VCDBDM (figures 3, 4 and 5) offers a complete structure, using which a vice chancellor of any public or private university can make better decisions to improve the ranking and performance of the university at international levels. In figure 5, the key performance indicators for each department, school/college at the left side, under the titles are dedicated towards the improvement of the university's performance and ranking, including: ***Teaching and Learning:*** 'Achievement of learners', 'Discipline referrals', 'Learning classroom attendance percentage', 'Percentage of learners' graduation', 'Satisfaction of instructors', 'Staff to student ratio', , 'Number of full time enrolled students', 'Male and female students ratio', 'Number of staff with PhDs', 'PhDs awarded to academic staff ratio' (if any), 'Doctorate to bachelor's ratio'. ***Research:*** 'Research Income (if any)', 'Research productivity – conferences and journals (papers per researcher or faculty)', 'Citations per paper' and 'Citations per faculty'. ***International Outlook:*** 'International to domestic students' ratio', 'International to domestic staff ratio', 'International collaborations or research network'. ***Industry:*** 'Industry Income (knowledge transfer)', 'Employer reputation survey'. ***Budget:*** 'Budget allocations', 'Institutional income'. ***Programs:*** 'Current and previous rankings of all the programs (academic reputation): like Arts and Humanities, Engineering, Medicine, Science and others', 'Overall international outlook of the HEI'. ***Benchmarking:*** 'Local and regional benchmarking', and 'International benchmarking'. The right side has supporting areas with detailed KPIs, shown in bullets. Vice chancellors are free to add any new area or shift any area from the right side (supporting areas) to the left side (Main KPIs) or vice versa, according to their needs (figure 5). Additionally, they might request the central information system department or central educational technology department to update the visual digital dashboard of decision making, accordingly.

Dear vice chancellors/heads/presidents of public and private universities of Oman, GCC, MENA and universal regions; what are you waiting for? The framework of VCDBDM is in your hands; use this framework of decision support system to solve your problems of effective decision making, based on the offered KPIs and revisions of policies or/and procedures to increase the rankings and performances of your universities. These significant KPIs of performance and ranking improvements given at the left side in figure 5 can be developed as software modules under similar tab titles by the central information system department of a university as the future work.

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