

The Case for Data Driven Strategic Decision Making

Edward M. Masha

Jomo Kenyatta University College of Agriculture and Technology, Mombasa Campus, Mombasa, Kenya
P.O. Box 90401 - 80100 Mombasa, Kenya
emasha@gmail.com

Abstract

The study examines the case for data driven strategic decision making. The quality of strategic decision making and effectiveness of implementing the selected strategies is increasing becoming more important in organizational developments. This calls for the adoption and usage of data driven decision making process in strategy management. Strategic data-driven decision making involves collecting data, analyzing that data, getting the data into the hands of the people who need it, using the data to increase efficiencies and improve performance and communicating data-driven decisions to key stakeholders. The elements of data driven strategic decision making and the various models are outlined. An application is considered of usage of data in strategic decision making in schools. This powerful tool in the education sector facilitates data collection, data analysis and application into the improvement plans. Its premium value is in facilitating informed decision making, boosting overall school performance and improved student achievement. A proactive leader who understands the vision and able to champions the cause is required in creating momentum behind any data-driven decision making tasks. Strategic decision making is an indispensable tool in moving organization on a sustainable success drive.

Keywords: Data, strategic, decisions, models, quality, performance, tools, analysis

1 Introduction

In strategy management field too little work has been done on what influences the quality of strategic decision making and the effectiveness with which strategies are implemented (Mulcaster, W.R. 2009). A recent example is the financial crisis of 2008-9 which could have been avoided if the banks had paid more attention to the risks associated with their investments. Due to the dynamics in strategy management, data-driven decision making has become a central focus of forward looking organizations policies and practice (Eden, 1998). Managers in such type of organizations are embracing commercial and home-grown data-driven decision making tools and support systems to help track and drive improvement and performance. The challenges facing implementation of many strategic data driven decision practices are technical, resources, financial and data quality. Infact getting started can be the toughest challenges of all. Data driven decision making is a relatively recent idea that has emerged in the last 10-15 years in response to the perceived lack of informed decisions (Pfeffer, 1998). The benefits of data-driven decision making results from organizations being able to work toward continuous improvement, meeting accountability requirements, focusing efforts and monitoring progress and developing a sense of community through organizational learning. Solid foundation of high quality data supports high quality business decisions. Organizations with high performance trends in profitability, growth and market place reputation have superior strategic decision making processes (Eisenhardt, 1999). Strategic choices and operating decisions may drive up company cost or down when faced with a wide selection of managerial decisions linked to services, product quality features, remuneration, inputs and distribution.

2 Data Driven Strategic Decision Making

2.1 The Linkages

Allison (1969) came up with three opposing models explaining the behavior of the parties involved in the Cuban Missile Crisis of 1962. The rational actor model is in line with rational and planning perspectives whereby people behave rationally hence focus is on selecting the optimal course of action after a comprehensive analysis during the decision making process. The organization process model indicates rational behavior is inhibited by ingrained organizational routines. For the bureaucratic politics models conflicting interest and objectives lead to processes of political maneuvering and positioning within the organization. Papadakis, Lioukas, & Chambers, (1998) reported that the dimensions through which strategic decisions are taken are based on comprehensiveness/rationality, financial reporting, role formalization, hierarchical decentralization, politicization and problem solving dimensions. The process dimensions are related to decision specific characteristics which includes perceived characteristics and objective typologies linked to strategic decisions. Additionally characteristics are based on management and the contextual factors focusing on external corporate environment and the internal firm scenarios. Decision specific characteristics have the most important influence on strategic decision making process. Different processes take place for decisions with different decision specific characteristics.

Today's organizational leaders use data extensively to guide them in decision making, setting and prioritizing goals, monitoring progress, defining needs, setting goals, planning interventions, and evaluation of progress. Analysis of the gaps between objectives for organizational and performance results in the actions of effective organization management. Decision tree which ranks options by progressively eliminating others is used in operational decision making (Johnson, 1984). The elimination process identifies the key criteria which includes growth, investment and diversification which will be incorporated in future developments. Data-based decision makers require adequate knowledge of the extent of the data that is needed for sustainable organizations improvement. Basic principles of measurement and assessment will enhance the implementation of data analysis skills. Technology is required to support the use of data and passionately engage stakeholders in using data to analyze strengths, weakness, threats, and opportunities for sustainable organizations improvement. Leaders are required to guide the staff on the mission, vision and objectives of the organization. Available data is used to inform the stakeholders about how well they are progressing toward meeting the goals and objectives of that mission.

Data-driven decision making has deep theoretical origins in the organizational-theory literature on continuous improvement and learning curves (Pfeffer, 1998). Data driven strategic decision making is about collecting appropriate data, analyzing that data in a meaningful fashion, getting the data into the hands of the people who need it, using the data to increase efficiencies and improve performance and communicating data-driven decisions to key stakeholders. An approach is to consider the Mulcaster's Managing Forces framework which addresses this issue by identifying 11 forces that should be incorporated into the processes of decision making and strategic implementation. The 11 forces are time, opposing forces, politics; perception, holistic effects, adding value; incentives, learning capabilities, opportunity cost, risk and style. When considering capability consideration in boundary decisions an alliance or collaborative partnerships is a much more appealing option than an acquisition (Thomson, 1993). Opportunities exist for a strategic alliance to be terminated if conditions change especially in scenarios of uncertain, fast changing market environments. Alliances and collaborative partnerships with foreign enterprises require appropriate structuring of the decision making process so that corrective actions can be implemented rapidly as technology and competitive changes happen on a super fast track. Decision making authority should be pushed down to the lowest organization level capable of making timely, informed competent decisions ((Thomson, 1993). The managers or non- managers who are nearest to the work place or shop floor, knowledgeable and well trained in the areas of work should lead the decision making and its execution process. Effective strategic decision making is applicable at the unit level to improvise business strategy, at the multi business level to create collective strategy and cross business synergies and lastly at the corporate level to expound important inflection points in strategic decision (Brown, 1998).

Data from all included studies are extracted independently by reviewers using pre-designed and piloted forms. Extracted data will reflect the study design, aims, methodological quality, setting, participants, and findings in relation to the review objectives (Khatri, & Alvin, 2010). Extracted data are compared for accuracy and completeness. This is whereby as the data is checked for missing, inconsistency and false entries as it undergoes processing by the extraction, transformation and loading tool. Errors found are corrected and any disagreements are resolved by consensus or by recourse to a third party in the review team. Big data describes collection of data sets which due to the large size and being complex are difficult to process using hand data management tools and even the traditional data processing applications. In reference to big data Couldry & Turrow (2014) mentions its embedding in personalized marketing and content production will affect the ecology of corrections that bring together citizens and groups via information, organization, empathy and celebration as members of a shared social and civic space. The risks will lead to elimination of the corrective media actions applicable to effective democracy. A vital challenge of big data is the optimal multiplexing and prioritization of different big data applications sharing the same underlying infrastructure (Zhang, Jain, Sarkar & Rupprecht 2014). This leads to resource contention between applications hence priority has to be given to the important applications or sub workloads in the application.

Studies should be heterogeneous with diverse theoretical underpinnings. In depth interview studies can bring out participants' views and experiences on barriers and facilitators to the use of research evidence and broad scale questionnaire surveys assessed the extent to which research evidence is used in practice. Data will be synthesized, and presented in the subsequent results section, separately for each review objective thus only combing data from similar studies. (Khatri, & Alvin, 2010). Data can be combined as a narrative review, with supporting tables. Data from individual studies are coded and organized according to the main themes identified in the systematic review objectives. Findings and interpretations are presented in the original authors' own terms without abstraction and without generating new theory (Khatri, & Alvin, 2010). Contradictory findings are explained in terms of study design, methodological quality, samples and settings accessed.

The data is stored in data warehouse. Inmon (1996) proposed the classic definition of a data warehouse as a subject oriented, non-volatile, integrated and time variant collection of data in support of management

decision. Data warehouse provide historical information about an organization which requires to be analyzed by the decision makers hence it's necessary to develop them in the context of a strategic business plan. The engineering approaches proposed for goal oriented requirements are based on obtaining the information requirement using traditional techniques and objection of the modeling. The traditional techniques are interviews, formal language, checklists and templates. The goal models are current organization goals, change goals, future business goals and evaluation goals. The historical data are analyzed by the decision makers, converting the data into storage information to support the decision making process (Giorgini et al, 2008). Data warehouse originates from a database which gathers and stores data from various remote information and heterogeneous sources of information (Al Nasser, 2014). It operates as an information system which is capable of extracting knowledge from the operational data stores of the business (Refer fig 1). Information related to suppliers, customers, markets and financial outcomes are provided. Data warehouse has capabilities to convert data into strategic information, which supports the decision making process at the higher levels of the organization.

Organizational learning is the process by which members of an organization acquire and use information to change and implement action (Pfeffer, 1998). Organizations which have systems where knowledge is distributed across functions and individuals and at the same time embedded in the culture, values, and routines of the organization are undergoing the process of organizational learning. Data can serve as a catalyst to propel organizational learning. Data refer to multiple sources and types of information. Leaders can use data to put into place mechanisms to support individual and collective learning surrounding data. Aspects of what information can be garnered from the data, changes of procedures resulting from it and other data to be collected are a boost. An organization professional status and organizational learning are well supported where the culture enhances the dispersion of data and its sharing. Infact for data to be useful to the organization, there should be a number of teams in place that can facilitate the data-driven processes. Data plays the role of gaining competitive advantage, optimization of resources, cost reduction, value creation, accuracy and accountability and hedging uncertainty (Kavale, 2012)

2.2 Strategic Decision Making Models

The manager must select which will be the future strategies of the organization after reviewing the possible strategies. Figure 2 shows the contexts within which decision making can take place within organizations and will have the specific decision models within them. The contexts are individual, group, organization, societal institutions and societal (Comerford, 1985).

2.2.1 Individual Context

The decision models focus on structuring or explaining the decision makers thought process. The factors for the individual decision maker are rationality, bounded rationality, incrementalism, intuitive and adaptive approaches. In rational decision making there is the maximizing of net value achievement which has sacrifice in one value is linked to a decision is greater than offset by an increase in the achievement of another value. The steps will involve setting up operational goals with weight inventory values and resources with weights have alternative strategies or solutions, have predicted benefits and costs of each strategy or solution choice. Computation of expected value of each choice and selection of the choice that has an outcome of the highest expected value. Bounded rationality is based on satisfying and settling for satisfactory scenarios for achieving goals. Satisfactory alternatives are available where there is a presence of a set of criteria that explains minimally satisfactory alternatives and the alternatives meets or exceed all the criteria. The bounded rationality decision model for strategy choice is dependent on set up of comprehensive set of operational goals and identification of priority values and available resources. By consideration of the organizational capabilities a set of action plan choices is formed. The critical costs and benefits of each choice are computed and selection of the choice with the greatest net benefit done.

The continuous trend of building out from the current scenario by step by step and small degree form the basis of the disjointed incremental model. Strategy choice is a process of continuing past strategies with only incremental modifications. Incremental approach is useful when existing strategy is acceptable and the strategy choice is close to the present strategy. Problems and incremental goals will be defined while appraisal of the current situation and estimation of incremental adjustments to be in line with the problems. The consequences of incremental adjustments are quantified and determined whether they are satisfactory. Implementation of incremental adjustments takes place where the consequences of incremental adjustments are satisfactory.

The intuitive approach is based on the years of management experience and high level of confidence achieved. It will apply in the short term future and involve less forecasting and planning. Adaptive approach is a way to use probability estimates to the strategy selection process. The features are on adoption of changing a strategy in relation to the outlook of existing circumstances. Determine the minimum acceptable values of variable which reflect the threshold to the goals and use them to reject the strategies which do not attain the minimum conditions. Ability to achieve targeted goal value will be useful in ranking strategy choices. Consider probability of attaining each goal for remaining strategies be assessed by the extent of the effects of the

environmental occurrences. The products of the feasibility estimate for each goal and its payoff for each remaining strategy choice is determined as the expected value. The strategy with the greatest expected value is selected.

2.2.2 Group Context

The decision models are based on groups as the major influence in decisions whereby they are composed of the Group and Elite models. The decision maker is a member of the group and the decision is a function of group interactions. The group model for strategy selection is an approach for balancing the interests of groups. It can apply to public policy balancing internal group influence and external groups interests and interests of coalitions in strategy selection. The Elite model of public policy where Elites shape mass opinion on policy questions can be applied to business strategy selection. Management can be effective Elite where there preferred decisions and strategy selections are implemented.

2.2.3 Organization Context

The system model features decision making as a function of a set of inputs which are derived in the organization and externally. System models features the organization decision process as a conversion step of strategy decision inputs into decision outputs. The outcome is a set of outputs when processed by the organization. Strategy is the dependent variable and organizational inputs the independent variables. Allison's organizational process model (II) emphasizes selection of strategy by inter organizational bargaining, goals agreement, expectations informally formulated and the first strategy choice which is an acceptable means towards fulfilling expectations selected. The Allison's model will operate in a political process. The political interplay between the various internal and external coalitions of the organizations leads to the selection of a strategy.

2.2.4 Institutional Context

Institutions are the primary factors in influencing strategy selection. Government policies are implemented and enforced after being adopted by a governmental institution. The relationship between business structure and strategy is an institutional scenario. Additionally the relationship between other institutional variables and strategy are also an application of the instructional model.

2.2.5 Global Context

Global factors are taken into consideration during the process of strategy formulation. The strategy selection model reflects the conceptual level of variables being considered in the decision process. The decision models determine the particular decision variable. Global influences comes in during strategy formulation on the aspects of structured analysis of competition in global industries. Global industries structural analysis will include foreign competitors, larger selection of potential entrants, larger scope of possible substitutes and more possibilities that the firms goals and personalities will be different and perceptions of what is strategically important (Comerford, 1985).

3 Usage of Data in Strategic Decision Making in Schools

3.1 Facilitation

Data driven strategic decision making is a powerful tool in the education sector with greater emphasis on school improvements. Data driven decision making facilitates continuous improvement in school by usage of fit for purpose data collection, analysis and applications into the improvement plans. The frameworks of effective data driven decision making techniques are used to analyze test scores, student achievements, reduce achievement gaps between student subgroups, improvement of teacher quality, improvement of curriculum, sharing best practices among schools and regions, communication of education issues more effectively with key stakeholders, promotion of parental involvement in the education process and increase dialogue within the educational community (Messelt, 2004). Education authorities have collected student and institutional information based on test scores, enrollment data, budget and finance information and human resources data. Data driven making process is proven to be worthwhile when the technology infrastructure requires upgrading, enabling acceptance of data collection and its applicable data analysis. The correlation between student activity level in relation to student discipline, performance and attendance can be found. Data and information are easily available which is conducive to knowledgeable decision making which enhances performance in the education sector

3.2 Developing Knowledge

Data can develop a solid blueprint of knowledge with measurable results for continuous improvement through its proper use. Achievement gaps are significantly reduced by data through the availability of quantifiable evidence which takes out the psychologically aspects and guesswork by the education and school authorities. Regions have an opportunity of analyzing performance data of categories of students including addressing problems at the school. Data aids in the evaluation of student composition including profiling them. This enables equitable distribution of resources as per justifiable needs and redistributing students to the appropriate classrooms. Teaching quality by incorporating data is improved by having systems which focus on specific professional development needs of region staff. Education officials and teaching staff are able to engage a proactive

approach when reviewing curriculum design and development with the usage of data driven decision making systems. Demographic data obtains characteristics and personal profile of the students and the schools. In some cases when considering the effects of synergies a multi criteria methodology is adequate to compile objectives aspects and developing optimization leading to opportunities for decision makers preferences to be included (Alencar & Almeida, 2008)

Data aids education officials and teachers to garner information which they might not otherwise have possessed. This includes identifying programs which are not performing and the root causes of problems. In such scenarios it's possible to have interventions such as holiday tuition, extra classes after normal time and other after-school programs as corrective actions. Data enables the determination of best practices in the schools which leads to superior performance levels. This encourages benchmarking to take place between the stakeholders. As outlined in fig 3 it's essential to acknowledge the impact of the tools, the outcome of the decision making process, the strengths of feedback loops and the differences among the level of end users in the region (Mandinach, Honey & Light 2006).

Procedural analysis of data will be able to identify strengths and weaknesses of students in the subjects taken. This makes it possible for teaching staff to identify specific areas of the curriculum/syllabus which will be required to be reviewed. The same approach will help the parents to participate well in students home works, assignments, parents teachers association and educational planning. Data from high quality observations have a greater potential to transform principal use of data related to human capital decision with focus on professional development, hiring and retention (Goldring et al, 2014). The consistency, transparency and specificity of observation data has more advantages over test score based measures when considering usage of teacher capabilities to shape decisions in the schools.

3.3 *Solutions of Data-Driven Decision Making Systems*

Organizations should be able to prepare there in house data driven decision making solutions and additionally procure turnkey data management and analysis systems. Working with vendors enables regions to streamline their data management and analysis investments, mitigating the costs associated with the unpredictability of the development and there maintenance aspects. The source of information is from schools information systems, financial authorities, human resources, examinations system, teachers development programs and other applicable stakeholders systems. Data is passed through the extraction, transformation and loading tool where missing or any errors are looked for and corrective actions taken. The data is stored in s data warehouse

The heart of the data driven decision making system is the data analysis. Its a analytical tool that does mining, forecasting and analysis of information from data sources and data warehouses, Users are able to process real time, produces customized reports and reduces the time and effort if manual approaches were to be used. Decision support tool recommends and outlines corrective measures to address problems resulting from the data analysis process. Analyse existing applications, data, documents and other artifacts so as to effectively monitor the progress and come up with well informed game changing decisions. Issues can be identified and corrective actions taken when data driven decision making is monitored in real time and feed back. Its important to have support services such as training, upgrades, assessments and maintenance from the suppliers of data driven decision making systems to be able to sustain the usages. This system users must enthusiastic learn and be high skilled to use strategies and procedures to enable achievement of higher operational efficiencies.

3.4 *Preparations*

Key to creating momentum behind any data-driven decision making effort is a proactive leader who understands the vision, champions the cause, helps others in the region realize the impact of data analysis and understands that the entire process takes time (Messelt, 2004). The requirements will be building collecting intuition to be able to see opportunities and threats faster and precisely. The quality of decision making is enhanced by forming diverse teams to stimulate quick conflict. Sustaining of the momentum of strategic choice is based on ensuring proper timing of strategic decision making. Decision makers should not engage in destructive interpersonal conflict and time wasting politics (Eisenhardt, 1999). The Education Officers generally translates the board's vision for the school region into measurable goals based on data and works with region authorities, staff, parents and other community stakeholders to craft plans for meeting goals by certain dates They will also collects data to show clear, steady progress and celebrates successes, evaluates shortcomings and revises plans for improvement based on data, along with the school board

The School Board generally: establishes a vision for the school based on data showing what has been achieved so far and what progress is necessary and spells out for the Education Officers and other employees and stakeholders, how region performance will be evaluated. They will review relevant data to evaluate regions progress toward identified goals and revises goals and plans for improvement based on data

Broad participation in improvement efforts serves to promote a high level of support for those efforts and generate sound solutions by expanding the discussion. There is motivation of participants and their

associates which increase the likelihood that the effort will lead to constructive action. Participants should prepare well for their role in implementing improvements and increase ownership of and commitment to specific strategies.

The best way for the leader to get started is to lay the groundwork for a region wide shift to a culture of information, education and communication. One way to do that is to find "data champions" throughout the organization. These "believers" should come from all levels. Successful integration of data-driven decision making also requires a team approach, particularly between the board of education and the education officials. The regions expectations must be clearly articulated, measurable and attainable, and individual roles must be clearly defined.

There are technical challenges to overcome, many of them involving availability and reliability of data. There is shortage of staff and resources, difficulties cleaning up data from multiple sources so that they are compatible, various entry and accuracy errors that, once analyzed, can lead to incorrect conclusions and the need to digitize large quantities of information and hitches arising from the quality of data. Lack of proper training and pressure of accountability were barriers to teachers in use of data driven decision making within response to intervention policy for improvement of academic achievement of risk students for high school teachers (Kressler, 2014). Data analysis is only as strong as the quality of data from which it is derived. If the data is suspect, concerns can be raised about the quality of decisions that administrators are making based on that data. To overcome these barriers, many regions have opted to pilot their data-driven decision making systems on a smaller scale with a specific school, program or group of students. By showing success on this level, they are able to build trust, create "data believers" and increase the likelihood of buy-in on a region level. (Messelt, 2004).

3.5 *Implementation of data-driven decision making system*

The beginning of the process commences by finding out what is to be learnt and the vision of data collection. An information audit is done to so at come up with the data being collected and review the compatibility of the data sources. It's essential to determine the type of additional data required where qualitative and quantitative data is of high value. Qualitative data can be gathered through surveys, administering questionnaires, interview schedules, observations and secondary sources. Data-driven decision making is all about correlating data elements and exploring those factors that contribute both positively and negatively to student and teacher performance (Messelt, 2004). To achieve the required standards paper systems need to be done away with, the compatible systems and networks should be able to receive data, have appropriate data with the universal keys and allocate responsibility for determined data elements. The approach can be overall usage of existing information technology systems or if not possible then acquire fit for purpose data management systems.

Knowledge of spreadsheets and data base techniques involving filtering, sorting, coding, histograms, charts and tables is required for data analysis. Additional statistical techniques such as correlation, regression and causation are required. Longitudinal measurements will make a difference to the outcome as they cover substantial periods to monitor progress, change and developments which could be even annually. Data should be broken down, categorized and coded to produce a snap shot of the information. The results of data interpretation should be made available at the in- process phase to enable commencement of the decision making task., Forums for teachers, education authorities and stakeholders should be available to enable participants to gain skills and have a shared understanding of the data to facilitate the decision making process. These dialogues help participants gain skills in data analysis. They learn to separate data from inference, to bring out multiple perspectives, to test out interpretations of data with additional data and relevant research, and to explore not just obvious explanations, but the root causes of problems (Nancy, 2001)

Defining new strategies is now possible after the outcome of understanding the relationships and even gaps in the data. Implementation of the strategies, changes and corrective actions takes place. Additionally benchmarking is incorporated to make gains from the performance of top notch schools and regions. The results should be shared out with the stakeholders through appropriate communication channels. This is in the form of simple tables, charts, histogram and the school reports covering the various itemized functions of the schools. All this indicates the importance of having appropriate systems approach to provide the opportunity to examine how data driven decision making is felt in the educational settings by identifying and understanding the interconnections among components that impact schools as complex and evolving systems. (Mandinach, 2005). Data driven enterprises will also require systems for advanced computation like clickstream log analysis, getting real time insights into streaming data, business forecasting and near – interactive experience for large volumes of data (Kunjir, 2014)

4 **Conclusion**

In school improvements data driven strategic decision making process is of premium value in facilitating informed decision making, boosting overall school performance and improved student achievement. The leadership has to prioritize data collection, data analysis, data interpretation and quality data usage in all aspects

of strategic decision making. Other beneficial areas are improving teaching quality, promote better communication, improve curriculum development, improve financial management, parent and other stakeholder participation. The involvement of information experts in supply, training, support and maintenance in usage of data analysis modules, data management systems is a crucial aspect of sustaining the facility. Data warehouse is capable of exerting an enterprise wide influence on the organizational infrastructure. There is a need to develop and validate data warehouse management systems success model and focus on the critical factors that facilitate and guide the effective implementation of the data warehouse. Data with effective security in place has the capacity to sustain efficiency and effectiveness during the process of strategic decision making. Workload traces are used in building powerful models for tuning data layouts across multiple systems. Availability of quality data enables control over the data through progress monitoring, setting business rules of having data governance policies. Strategy decision making is an indispensable tool in moving a company on a sustainable success drive that ensues maximum profits and long term positioning.

References

- 1 Alnassar, B.Y (2014). "Challenges in the successful implementation of data warehouse". *Juornal of Management Research*. ISSN1941 – 899 X, 2014. Vol 6, No 3. doi:10.5296/jmr.v6i3.5196.
- 2 Alencar, L.H & Almeida, A.T. (2008). "Multi - criteria decision group model for suppliers selection". *Pesquisa Operacional*. 28. 321-337
- 3 Allison, G (1969). "Conceptual models and the Cuban missile crisis". *The American Political Science*, Review no 3, September 1969, pp 689-718.
- 4 Brown, S.L & Eisenhardt, K.M (1998), "*Competing on the edge: Strategy as structured chaos*". Boston, Harvard Business School Press.
- 5 Cheng, J. (2008). "The impact of strategic decisions on construction client satisfaction: An assessment framework". (Doctoral dissertation). Retrieved from <http://eprints.hud.ac.uk/4708/>
- 6 Comerford, R.A, & Callaghan, D.W. (1985). "*Strategic management – Text, tools and cases for business policy*". Boston: Kent Publishing Company.
- 7 Couldry, N & Turrow, J (2014). "Advertising, big data and the clearance of the public realm: marketers new approaches to the content subsidy". *International Journal of Communication* 8, .1710 – 1726. Retrieved from <http://eprints.lse.ac.uk/57944/>
- 8 Eden, C. (1998), "*Making strategy, The Journey of strategy management*". London, Thousands Oaks, New Delhi. Sage Publications Ltd
- 9 Eisenhardt, K.M (1999). "*Strategy as Strategic Decision Making*". Retrieved from <http://sloanreview.mit.edu/article/strategy-as-strategic-decision-making/>
- 10 Giorgin, P, Rizzi, S & Garzetti, M. (2008). "Grand: A goal oriented approach to requirement analysis in data warehouses". *Decision Support Systems*. 45, 4-21
- 11 Goldring, E, Grissom, J.A, Neumerski, C, Cannata, M, Rubin, M, Drake, T, Schuermann, P (2014). "Move over value added measure: Principals human capital decisions and the emergence of teacher observation data". Retrieved from <http://principaldatause.org/assets/files/additionals/Move-Over-Value-Added-Measures-June-2014.pdf>
- 12 Humphries, M, Hawkins, M.W & Dy, D.K. (1999). "*Data warehousing; Architecture & Implementation*". Prentice Hall. PTR.
- 13 Inmon, W.H. (2005). "*Building the data warehouse*". Indianapolis, IN: Wiley Publishing Inc.
- 14 Johnson, G & Scholes, K. (1984). "*Exploring corporate strategy*". Harlow. Pearson Education Ltd.
- 15 Kavale, S. (2012). "The role of data in strategic decision making process". *International Journal of Current Research*. Vol.4, issue 04, 001-007. Retrieved from <http://www.journalcra.com>
- 16 Kressler, B (2014). "*High school teachers' perceptions of data driven decision making within a response to intervention frame work*". (Doctoral dissertation). Retrieved from <http://scholarly-repository.miami.edu/oa-dissertations>.
- 17 Khatri, N & Alvin Ng, H. (2010), "Role of intuition in strategic decision making". *Human Relations*, Volume 53(1), 57-86. Retrieved from <http://fagbokforlaget.no/boker/downloadpsykorg/KAP7/artikler/Intuisjon%20og%20strategiske%20beslutninger.pdf>
- 18 Kunjir, M, Kalmegh, P & Babu, S (2014). "Thoth: Towards managing a multi-system cluster". *Proceedings of the VLDB endowment*, Vol. 7.No. 13 Retrieved from <http://www.vldb.org/2014/program/papers/demo/p1157-kunjir.pdf>
- 19 Leal, C.A, Selpuveda, S, Mate, S, Mazon, J.N, Trujillo, J. (2014). "Goal oriented requirements engineering in data warehouses: A comparative study" Retrieved from <http://www.revistas.unal.edu.co/index.php/ingevin/article/viewFile/44708/46151>

20 Mandinach, C.B, Honey, M & Light, D (2006). “A theoretical framework for data driven decision making”. Retrieved from

<http://olms1.cte.jhu.edu/olms/data/resource/7571/DDDM%20Data%20to%20Knowledge.pdf>

21 Messelt, J. (2004). “Data –Driven Decision making: A Powerful Tool for School Improvement”. Retrieved from https://www.erc.k12.mn.us/promo/sage/images/Analytics_WhitePaper.pdf

22 Mulcaster, W.R. (2009). “Three strategic frameworks”. *Business Strategy Series*. Vol 10.No 1,pp 68-75. doi: 10.1108/17515630910937814

23 Nancy, L. (2001). “Using Data/Getting Results: A practical guide for school improvement in mathematics and science”. Norwood, MA; Christopher Gordon Publisher.

24 Papadakis, V.M, Lioukas, S, Chambers, D (1998). “Strategic decision making process: The role of management and context”. *Strategic Management Journal*, 1998, 19, 115 -147

25 Pfeffer, J. (1998). “The Human Equation: Building Profits by Putting People First,” Boston, MA: Harvard Business School Press,

26 Thomson Jr, A.A, & Strickland III, A. J. (1993). “Crafting and executing strategy – Text and readings concepts & cases”. Burr Bridge. Irwin.

27 Zhang, R, Jain, R, Sarkar, P, & Rupprecht, L. (2014). “Getting your Big Data priorities straight: A determination of priority - based QoS using social – network - driven stock recommendation”. *Proceedings of the VLDB endowment*, Vol. 7.No. 13. Retrieved from <http://www.vldb.org/2014/program/papers/demo/p1144-zhang.pdf>

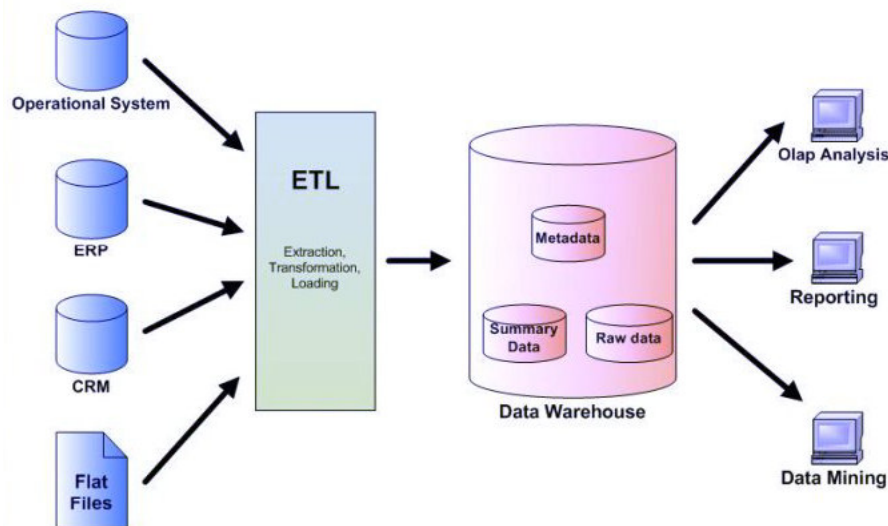


Figure 1 Architecture of a Data warehouse (Humphries, Hawkins & Dy, 1999)

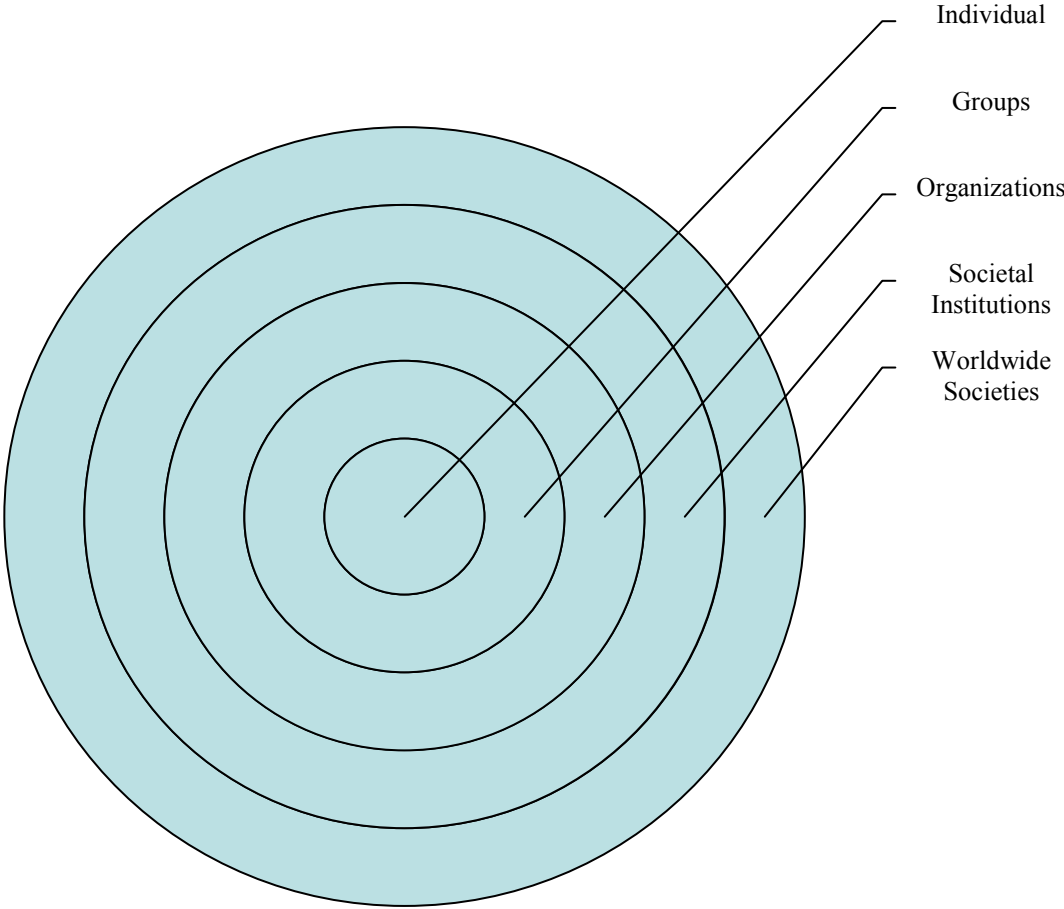


Figure 2. The contexts within which decision making can take place (Comerford, 1985).

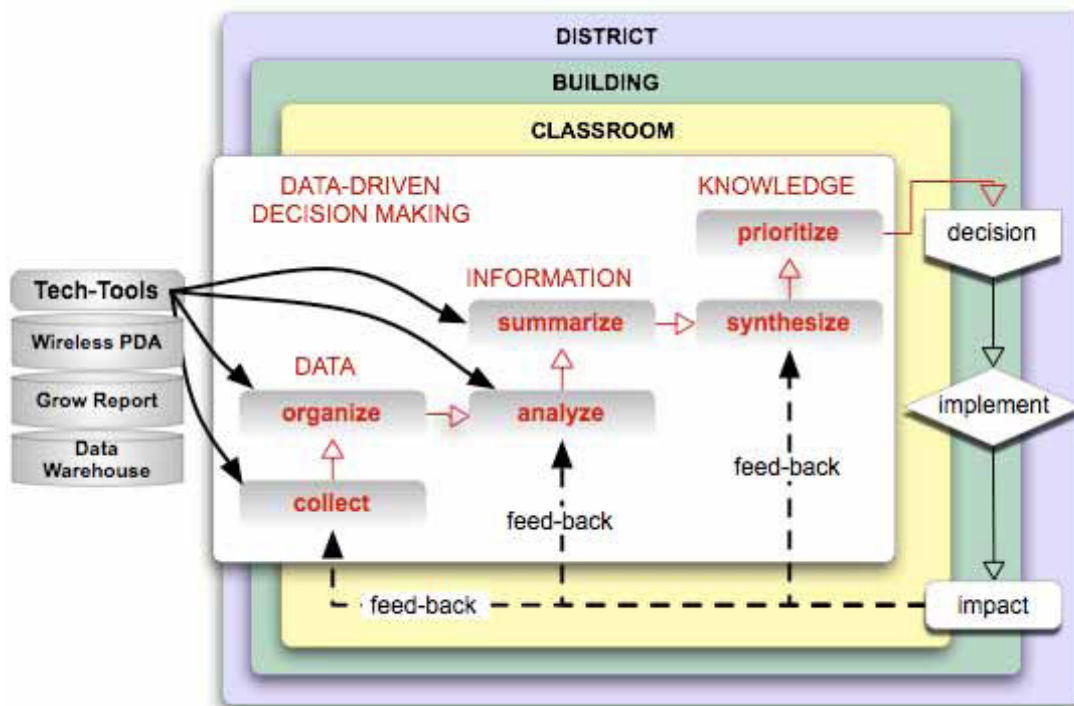


Figure 3 Framework for Data Driven Decision making (Mandinach 2006)