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Special Issue

Joseph M. Juran, a Perspective on Past Contributions and Future Impact

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This paper combines presentations by the authors in a special session dedicated to the work of Joseph M. Juran at the sixth annual conference of the European Network for Business and Industrial Statistics in Wroclaw, Poland. The paper offers an historical perspective of the contributions of J. M. Juran to management science emphasizing aspects of cause and effect relationships and Integrated Models. Specifically, the paper presents the Juran concepts of Management Breakthrough, the Pareto Principle, the Juran Trilogy® and Six Sigma. The impact of these contributions, put in an historical perspective of key thinkers who investigated cause and effect relationships, is then discussed. The impact of these contributions to modern Integrated Models is then assessed. Copyright © 2007 John Wiley & Sons, Ltd.

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1. INTRODUCTION

The career of Joseph M. Juran is unique in many aspects. It combines innovation, impact and longevity. This article is a perspective on the contributions of J. M. Juran to management methodologies and an evaluation of its impact on future developments in this area.

The main theme presented below is that Joseph Juran has uncovered, for the benefit of managers all over the world, major cause and effect relationships between management decisions and their impact on companies and organizations. An understanding of these relationships has helped thousands of managers better manage their companies.

These contributions include the universal Pareto Principle, the managerial breakthrough sequence, and the famous Juran Trilogy® where process improvement, planning and control combine to unleash tremendous forces driving organizations to improve products and services, profitability and their competitive position.

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What is not well recognized is how the steps defined in his classic 1964 text, *Managerial Breakthrough* reprinted in 1995[1], clearly lay out, for the first time, the principles of continuous quality improvement. Additional contributions include measuring quality in financial terms and quality costs in general, quality terminology, management responsibilities, self-control, strategic quality planning, and Juran's outstanding clarity and very structured way of presenting subjects.

We suggest that *Integrated Models*[2] are a new vision of how to manage organizations that is directly influenced by the work of Joseph Juran. Further developments in this direction can therefore be also considered a contribution of Joseph Juran to management science.

We begin with a review of the background and career of Joseph Juran. We then describe, in some detail, the Management Breakthrough sequence advocated by Juran and the Juran Trilogy® which is the foundation of the Six Sigma Define–Measure–Analyze–Improve–Control (DMAIC) and Design for Six Sigma (DFSS) processes. In a follow-up section we discuss causality models and then cover Integrated Models. The paper concludes with some summarizing remarks.

2. BACKGROUND ON JOSEPH M. JURAN

Joseph Moses Juran was born in Braila, Romania on December, 1904. In 1912 young Joseph Juran moved to Minnesota, USA and demonstrated his affinity for knowledge. In school, his level of mathematical and scientific proficiency exceeded the average that he eventually skipped the equivalent of four grade levels. In 1920, he enrolled at the University of Minnesota, the first member of his family to pursue higher education.

Juran received his BS in electrical engineering in 1924 and started work at Western Electric in the Inspection Department of the Hawthorne Works in Chicago, an enormous factory that, by its peak in 1929, employed more than 40 000 workers, 5200 in the Inspection Branch. In late 1925, AT&T's Bell Telephone Laboratories set in motion Statistical Quality Control (SQC), a special initiative that would have a profound impact on Juran's life and on industry in general. SQC involved applying statistical tools to solve factory quality problems. The Hawthorne Plant soon discovered its workforce lack of knowledge in statistical methodology and a young professor, Walter Bartky from the University of Chicago, was asked to teach an in-house course in statistics to 20 managers and engineers. Juran was one of those selected. A new department was then created to drive this program at Hawthorne, the Inspection Statistical Department, one of the first of such divisions created in America. Juran and another engineer prepared and delivered a training course on statistical methods to all supervisors in the Inspection Branch introducing them to SQC and new sampling tables. Later Juran was asked to deliver this course also to all senior managers of the Inspection Division.

In 1937, Juran became the Corporate Industrial Engineer for Western Electric in its New York corporate headquarters. His work included visiting other companies and discussing methods of quality management. Thirteen days after Pearl Harbor the Western Electric President received an urgent telegram from the Statistics Division of the Lend-Lease Administration requesting the services of Joseph M. Juran for six weeks. Juran started work with the Lend-Lease program on Christmas Day, 1941. This temporary leave of absence from Western Electric stretched for almost four years. He and his team improved the efficiency of processes, eliminated excessive paperwork and thus hastened the arrival of supplies to the United States' overseas allies. Juran finally left Washington in September1945, but he did not return to Western Electric and chose to devote the remainder of his life to the study of quality management. The term he used was 'to start a journey on my own canoe.' He accepted a position as Professor of Industrial Engineering and Chairman of the department in New York University's College of Engineering. He also made an alliance with Wallace Clark whose small consulting company had a high professional standing and international scope. Clark had worked with Henry L. Gantt and had written, *The Gantt Chart*, a leading book on scheduling facilities.

As early as 1928, Juran had written a pamphlet entitled 'Statistical Methods Applied to Manufacturing Problems'. His book, *Management of Inspection and Quality Control*, had also been well received.

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His academic assignment with New York University permitted him time to create a thriving consulting practice, to continue writing and deliver lectures for American Management Association. It was his time with NYU and the AMA which allowed for the development of his management philosophies which are now embedded in the foundation of American and Japanese management. His classic book, the *Quality Control Handbook*, first released in 1951, is still the standard reference work for quality managers[3].

The publication of the *Quality Control Handbook* led directly to an invitation by the Union of Japanese Scientists and Engineers for Dr Juran to Japan to teach Japanese leaders the principles of quality management as they rebuilt their economy. In 1981 he received the Order of the Sacred Treasure, Second Class from Emperor Hirohito of Japan for '*...positively contributing for a long time not only to the development of Quality Control in Japan, but also to the facilitation of the U.S. and Japan friendship*'. In 1960 W. Edwards Deming had received the same award for his contributions to the Japanese census and his work there teaching the methods of quality control. Along with his series of quality control handbooks, Juran's impact was greatest through his many other management books. His publication of *Managerial Breakthrough* in 1964 cemented his reputation as a leading thinker in both quality management and general management. In 1979, Juran founded Juran Institute to better facilitate broader exposure of his ideas. At first, the Institute focused on creating and distributing a set of videotaped lectures, *Juran on Quality Improvement*. Over 3000 sets of these tapes were used by leading companies throughout the world, several companies asking for open licenses to reproduce as many copies as needed to train all employees. In 1987, Juran 'passed on the torch' to Dr A. Blanton Godfrey who came from Bell Laboratories where he was head of the Quality Theory and Technology Department originally managed by W. Shewhart in the 1920s. In 2000 Dr Godfrey left the Juran Institute to become Dean and Joseph D. Moore Professor of Textile & Apparel Technology & Management, College of Textiles, North Carolina State University. Juran Institute remains today one of the leading quality management consultancies in the world producing books, workbooks, videos and other materials to support the wide use of Dr Juran's methods. Dr Juran worked to promote quality management into his 90s, and only recently retired from his semi-public life.

3. MANAGERIAL BREAKTHROUGH

Managerial breakthroughs materialize in different ways. The most obvious and measurable one is the performance breakthrough which includes a breakthrough in knowledge and natural resistance to change. A more subtle change is the cultural breakthrough. Performance breakthrough is achieved through a universal sequence[1]:

- Proof of the need.
- Project identification/Organization to guide each project.
- Organization for diagnosis/analysis of projects.
- Diagnosis—breakthrough in knowledge.
- Remedial action on the findings.
- Breakthrough in cultural resistance to change.
- Control at the new level.

Godfrey[4] lists seven milestones that delineate a road map for the top management of organizations planning their journey toward continuous quality improvement. The milestones are:

(1) *Awareness* of the competitive challenges and current competitive position.
(2) *Understanding* of the definition of quality and of the role of quality in the success of the organization.
(3) *Vision* of how good the organization can really be.
(4) *Planning* for action with clearly defined steps needed in order to achieve the vision.
(5) *Training* of the people so as to provide the knowledge, skills and tools needed to make the plan happen.

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(6) *Support* actions taken to ensure that changes are made, problem causes are eliminated and gains are held.
(7) *Rewards and recognition* of achievements to make sure that quality improvements spread throughout the organization and become part of the business plan.

The next section describes the famous Juran Trilogy® and provides a brief overview of Six Sigma. The description of the Trilogy is from Juran's classical text on leadership[5].

4. THE JURAN TRILOGY® AND SIX SIGMA

Juran's Trilogy® is possibly the most simple, complete, and pure representation of managing for quality ever devised. Juran found it useful to teach about managing quality using an analogy that all managers easily understand, managing finance. Financial management is carried out by the use of three managerial processes: financial planning, financial control and financial improvement. Managing quality makes use of the same three fundamental processes of planning, control and improvement. The trilogy exemplifies the essence of quality. It completely meets its objective in the most efficient and effective manner possible. *Quality Planning*: the process for designing products, services, and processes to meet new breakthrough goals; *Quality Control*: the process for meeting goals during operations; *Quality Improvement*: the process for creating breakthroughs to unprecedented levels of performance (see Figure 1).

While Juran's Trilogy® is simple and accurate, it is important to understand that the elements represented are infinite and layered. To properly implement products, services and processes according to Juran's ideal, one must understand that the Trilogy is three dimensional and limitless. For example, the Quality Planning phase of a new market offering will consist of Quality Planning for products, services, processes, suppliers, distribution partners, etc. for delivery of the offering. On another layer, this phase must also plan for the support and maintainability of the offering. On yet another layer, the planning phase must account for design and integration of data collection, control, improvement processes, people, and technologies. Finally, the planning phase must design the evaluation of the planning phase itself. In this simple example, we see four layers of Quality Planning. This phase will be iterated and improved with every

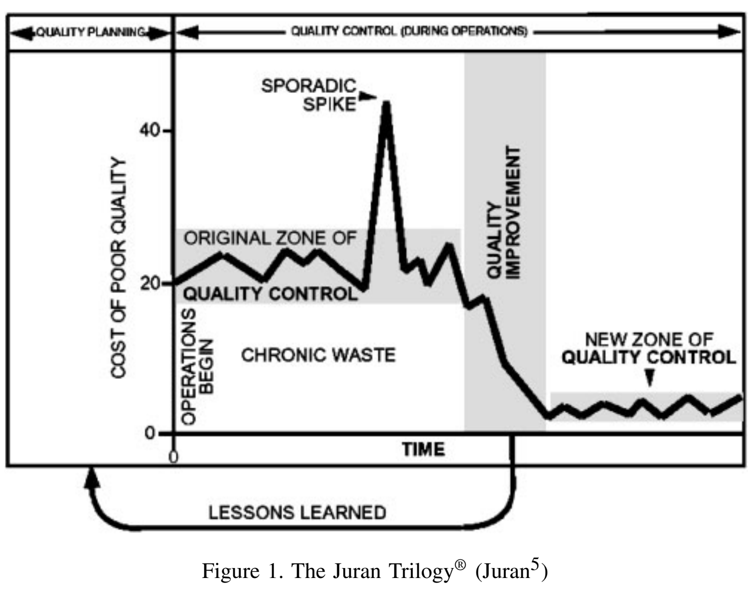

Figure 1. The Juran Trilogy® (Juran[5])

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cycle (minimally) and within each cycle (optimally). The same is true of all other phases (retrieved from http://en.wikipedia.org/wiki/Juran%27s_Trilogy, March 2007).

In recent years many of the world's leading companies have adopted the philosophy of Six Sigma Quality. The term, Six Sigma Quality, was coined at Motorola in 1987 to describe their intense effort to create a culture of quality improvement using a philosophy of the pursuit of perfection. These concepts and methods have evolved over the years through the experiences of companies such as General Electric, Honeywell, DuPont, Caterpillar, Bank of America and others. Six Sigma is now thought of as a roadmap, a philosophy, and a rich set of statistical and other tools that support breakthroughs in profitability and in quality, whether a company's products are durable goods or services. Sigma is a letter in the Greek alphabet used to denote the standard deviation of a process (standard deviation measures the variation or amount of spread about the process mean). Motorola calculated that processes centered on target with six standard deviations from the upper and lower specifications would produce essentially perfect products (actually over two parts per billion out of spec). But since most processes have some shift around the mean, Motorola allowed for a 1.5 standard deviation shift of the mean, meaning, in their terms, a Six Sigma process creates no more than 3.4 parts per million falling outside of the specification limits. The higher the sigma number, the better.

The Six Sigma term refers to aggressive goals and to a management infrastructure utilized to drive out waste and improve the quality, cost and time performance. Six Sigma implementation is through projects of different size and duration. We define a project as a structured and systematic approach to achieving Six Sigma levels of improvement. Six Sigma levels are achieved using the *Define–Measure–Analyze–Improve–Control* (DMAIC) problem solving and improvement methodology. DMAIC is in fact the Juran Quality Improvement sequence. Crucial to any successful Six Sigma implementation are its champions or sponsors. These senior management personnel are charged with driving and supporting Six Sigma to achieve business and operational objectives by driving out waste and increasing customer satisfaction.

A managerial level engineer or technical specialist assigned full responsibility to implement Six Sigma throughout the business unit is often referred to as a Black Belt. A Green Belt is a person with slightly less training who has sufficient knowledge to support and champion Six Sigma implementation and to participate in Six Sigma projects as team leader or team member. Black Belts are described by Juran as process improvement facilitators. DFSS is a focused effort designed to design new services or products. Again, DFSS is the Quality Planning sequence so well described by J. M. Juran. Overall we can see that the Six Sigma of the 1980s directly builds on methodologies developed by Juran in the 1960s.

A Black Belt is a Six Sigma implementation expert, and each major project is expected to have at least one Black Belt as a leader or a team member. Many companies have experienced the benefits of Six Sigma with, on average, savings between $150 000 and $200 000 per project. Black Belts with 100% of their time allocated to projects can execute as many as 4, 5, or 6 projects during a 12-month period, potentially adding over $1 million to annual profits.

One particularly eloquent testimonial is provided by *Robert W. Galvin*, Chairman of the Executive Committee, Motorola, Inc., in his foreword to a book by Kenett and Zacks[6]:

> *At Motorola we use statistical methods daily throughout all of our disciplines to synthesize an abundance of data to derive concrete actions. . . .How has the use of statistical methods within Motorola Six Sigma initiative, across disciplines, contributed to our growth? Over the past decade we have reduced in-process defects by over 300 fold, which has resulted in a cumulative manufacturing cost savings of over 11 billion dollars.*
>
> R. Galvin, in Kenett and Zacks[6]

De Konig and De Mast[7] analyze in depth the Six Sigma methodology focusing on the DMAIC process they refer to as the 'Breakthrough Cookbook.' They invoke several approaches for evaluating DMAIC including empirical, reconstruction and grounding research. They do not mention explicitly the work of J. M. Juran but their analysis can be applied directly to it. Their paper is yet another example demonstrating how Juran's ideas create cause and effect relationships in business and industrial processes.

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5. CAUSE AND EFFECT MODELS

At a presentation celebrating 50 years to the establishment of a Masters Degree in Statistics in Norway Odd O. Aalen has been quoted as stating that: '*Statistics is important because it is conceived as contributing to a causal understanding … Statistics can indicate causality even in the absence of a mechanistic understanding. But the traditional self-conception of statistics is that it can rarely say anything about causality. This is a paradox*'[8].

Statisticians have indeed been careful not to confuse correlation with causality (e.g. Cox[9]). A famous example derived from statistics on the population of Oldenburg in Germany and the number of observed storks in 1930–1936 demonstrates a spurious correlation due to a lurking variable, time[10]. Sketch a scatter plot of population size versus number of storks in the table below and you will see what we mean, if a cause and effect relationship is implied by the data. This simple plot has been used in hundreds of statistics courses—and now in almost every Six Sigma course—to warn students of the dangers of assuming causality too quickly.

Year	1930	1931	1932	1933	1934	1935	1936
Population in thousands	50	52	64	67	69	73	76
Number of storks	130	150	175	190	240	245	250

Causality is a basic component of the scientific method and general learning. Establishment of causality relies on a combination of axiomatic thought and empirical evidence derived from observational studies of designed experiments. A review of key thinkers and writers in this area covers many centuries and continents.

Sir Francis Bacon (1561–1626) was the chief figure of the English Renaissance and an influential advocate of 'active science.' He writes in Novum Organum. (New Method, 1620) '… *the true method of experience … first lights the candle*, *then by means of the candle shows the way*; *commencing as it does with experience duly ordered and digested*, *not bungling or erratic*, *and from it educing axioms*, *and from established axioms again new experiments…*'

Science should start with what Bacon called Tables of Investigation. The Table of Presence lists instances in which the phenomenon being studied occurs. The Table of Absence in Proximity includes the important negative instances; these are the ones most like the positive instances. The Table of Comparison compares the degrees of the phenomenon. Interpretation begins with a brief survey which will suggest the correct explanation of the phenomenon. Although this 'anticipation' resembles a hypothesis, there is in Bacon's discussions no clear indication that he recognized the central scientific importance of devising and testing hypotheses. He goes on to consider 'prerogative instances', those most likely to facilitate interpretation, of which he classifies 27 different types. By following the method outlined, scientific investigation is supposed to produce, almost mechanically, a gradually increasing generality of understanding, a 'ladder of axioms' upon which the mind can climb up or down.

One century later, the Scottish philosopher David Hume (1711–1776) observes that:

1. Analytical claims are product of thoughts and empirical claims are a matter of fact.
2. Causal claims are empirical.
3. All empirical claims originate from experience.

The 20th century saw an increase in the attention given to the concept of causation and the role of experimentation. For example Albert Einstein (1879–1955) has been quoted as stating that: '*Development of Western science is based on two great achievements: the invention of the formal logical system* (*in Euclidean geometry*) *by the Greek philosophers, and the discovery of the possibility to find out causal relationships by systematic experiment*,' A. Einstein, 23 April 1953.

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W. Edwards Deming (1900–1993) made the important distinction between analytical and enumerative studies[11]. The enumerative question is 'how many?,' the analytic question is 'why?.' In a dedicated preface to the *Economic Control of Quality of Manufactured Product* by W. Shewhart, Deming states that: '*Statistical theory*, *as taught in the books*, *is valid and leads to operationally verifiable tests and criteria for an enumerative study. Not so with an analytic problem*, *as the conditions of the experiment will not be duplicated in the next trial. Unfortunately*, *most problems in industry are analytic*'. The control chart introduced by Shewhart in the Western Electric Company in 1924[12] is actually a mixture of enumerative and analytic thinking. The control limits indicate where we predict the process statistic to behave under stable conditions, the signaling rules are designed to indicate a change in the ongoing process and trigger some correction action to get the process back on track. If the process was subjected to an improvement effort, then the change would be welcome and new control limits computed to indicate the new process capability.

More recently, J. Pearl single handedly developed a complete theory of causal diagrams for empirical research with significant impact on Structural Equation Models and Bayesian Networks, where cause and effect relationships are directly integrated into mathematical models[13,14].

It is in this context that we want to present some of the contributions of Joseph M. Juran. Specifically, we will concentrate on Managerial Breakthrough, the Pareto Principle and the Juran Trilogy®[15].

Managerial Breakthroughs are a well-organized sequence of steps planned to generate a structured cause and effect relationship. Proof of the need is an antecedent to the sequence which generates the 'raison d'etre' and energy required to complete the cycle. The nine steps for managerial breakthrough described by Juran in 1964 have been through many evolutions over the years cumulating in today's simple Six Sigma improvement process of Define, Measure, Analyze, Improve and Control.

The Pareto Principle is a universal law that attributes 80% of events to 20% of possible causes. Many years ago Juran extended the ideas of the Italian economist, Wilfredo Pareto from the wealth of individuals and countries to phenomenon ranging from business to everyday life. This famous law is a key concept in management thinking and decision-making processes. Here again, J. M. Juran clearly established a working approach to handle causes in an efficient way now universally adopted.

The Juran Trilogy® is, yet again, a wonderful example of cause and effect relationships. Quality improvement is focused on reducing chronic problems by inducing structural changes and process improvements. The Juran quality improvement steps, later codified in the DMAIC process, are designed to impact causes so that the effect is an improvement in efficiencies and quality. Quality planning is a process focused at 'closing the alligator hatchery.' Alligators are the quality problems that keep biting us. Improved planning helps prevent problems so that we are reaching the market faster with better products and services. Quality control is another prime example where cause and effects are analyzed and managed to 'hold the gains.' Proper quality control operationalizes a clear cause and effect relationship.

In all these areas J. M. Juran has contributed to identify and leverage cause and effect relationships for the practical benefit of organizations, consumers and citizens. The next section will cover Integrated Models, an expanding area in quality management building on the contributions of J. M. Juran.

6. INTEGRATED MODELS

Integrated Models are gaining much attention of researchers, standard organizations and practitioners (see Kenett[2], MacDonald *et al.*[16], and Watkins[17]).

An early example of an integrated model was implemented by Sears Roebuck and Co. in what they call the employee–customer–profit model[18]. A cause and effect chain links three strategic initiatives: (1) to be a compelling place to work; (2) to be a compelling place to shop; and (3) to be a compelling place to invest. In order to push forward these initiatives, Sears' management looked for answers to three basic questions: (1) How do employees feel about working at Sears? (2) How does employee behavior affect customers' shopping experience? and (3) How does customers' shopping experience affect profits? The model presented

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below reflects detailed answers to these questions and identifies the drivers to improve employee retention, customer retention, customer recommendation and profits.

Sears has been able to map out these variables and determine that, for them, a 0.5 increase in employee attitude could lead to a 1.3 unit increase in customer satisfaction that in turn could lead to a 0.5% increase in revenue growth (see Figure 2).

Kenett[2] presents a generic integrated model that has been implemented in companies in a variety of industries. The basic building block of the model is data representing (1) voice of the Customer, (2) voice of the Process and (3) voice of the Workforce.

For example, in a company specializing in Home Office Delivery (HOD) of water bottles we were able to establish that increase in average employee satisfaction from their immediate supervisor, by branch, is directly related to average customer satisfaction from that branch (see Figure 3). In the six branches investigated higher employee satisfaction correlates so well with higher customer satisfaction, which we can predict customer satisfaction quite closely on the basis of employee satisfaction level alone.

The approach presented in Kenett[2] to implement an integrated model, consists of analyzing internal operational data, customer and employee surveys, using an interdisciplinary research teams. A brief sketch of the approach is presented in Figure 4.

Implementing Integrated Models in a global setting requires a pragmatic approach like in Six Sigma implementation. Kenett and Albert[19] discuss how this can be done in international organizations.

Kaplan and Norton introduced in 2004 strategy maps, an improved version of their original balanced scorecards[20]. A strategy map develops strategic cause and effect relationships by linking measures of financial performances to measures on their drivers. To build a strategy map the authors suggest a top down approach, starting with financial performances to be followed by cross-perspective routes leading to these performances. Norton[21] describes the strategy map as a set of hypothetical causal relationships to be continually tested and revised and suggests testing causal linkages by means of statistical correlation analysis. However, correlation analysis is a relatively crude tool. It can only measure the strength of the relationships

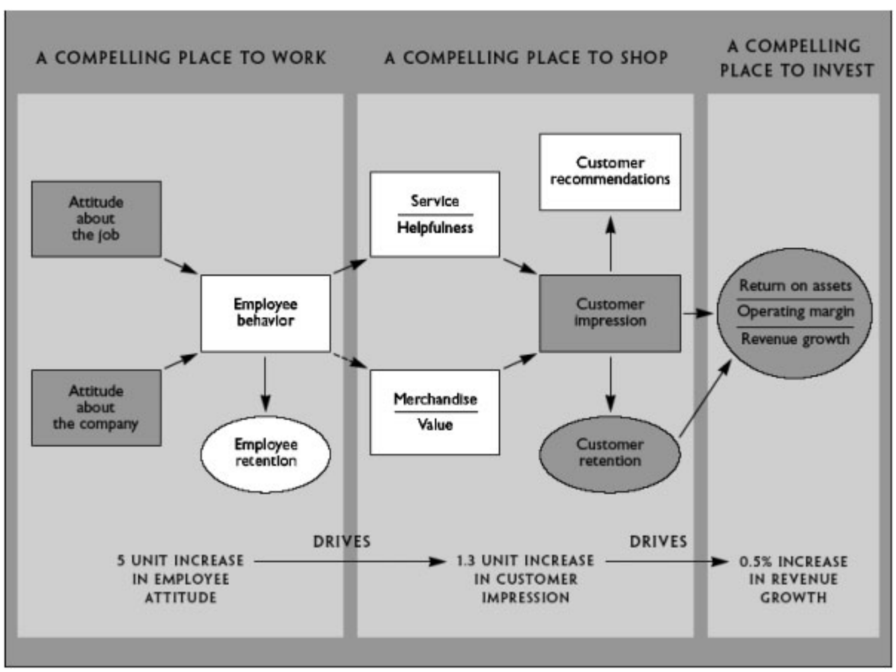

Figure 2. The Sears employee–customer–profit model (Rucci *et al.*[18])

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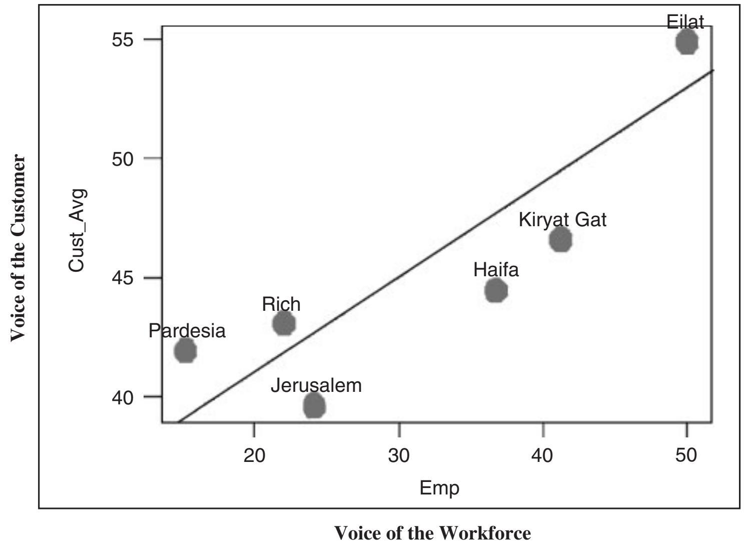

Figure 3. Customer satisfaction versus employee satisfaction (Kenett[2])

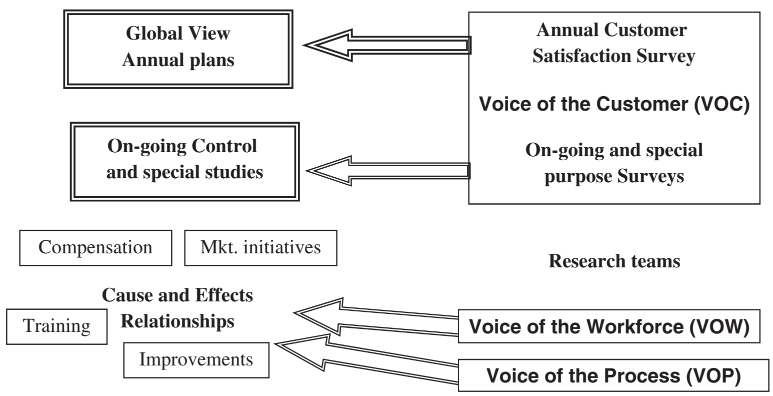

Figure 4. A general framework for designing and implementing Integrated Models

among performances and does not consider the time element involved. By contrast, techniques utilized in statistical process control seem to be more appropriate. Dror and Barad[22] develop a validation process for dynamically investigating performance linkages as implied by a given strategy map. The proposed validation process takes into account the time dimension in performance measurement as well as the time lag between causes and their effects.

7. DISCUSSION

Juran has given us a strong foundation upon which to build modern quality management. Over the years many new concepts, tools, and methods have been introduced. Today many organizations call these methods Six Sigma Quality. The challenge continues to be of integrating new ideas, new tools and new methods into a comprehensive framework to drive organizational success. Recently Robert Galvin, Chairman and CEO of Motorola during their creation of Six Sigma and winning of the Malcolm Baldrige National Quality Award, was talking about the challenge of continuously capturing new ideas and driving company performance[23]. Galvin stressed the need for executives and managers to become knowledgeable about all tools and techniques and to take active leadership in assuring that key people throughout the organization are skilled in their deployment in obtaining the organization's strategic goals. In fact Galvin points out that improved competitiveness comes from increased maturity of an organization in applying statistical methods. This general phenomenon has been labeled 'The Statistical Efficiency Conjecture' by Kenett *et al*.[24] that tries to determine the factors affecting Practical Statistical Efficiency as defined in Kenett *et al*.[25]. A multidisciplinary emphasis is the basis for the Integrated Models discussed in the previous section. Integration seems therefore a main challenge in management science, statistical analysis and quality systems. Juran's contributions are playing a key role in the foundations of this advanced approach. The purpose of this paper was to review these contributions and show, among other things, their link to cause and effect and Integrated Models.

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Authors' biographies

A. Blanton Godfrey (Blan) is Dean and Joseph D. Moore Professor of Textile & Apparel Technology & Management, College of Textiles, North Carolina State University. The College is the leading institution of its type in the world and produces over half the doctorates in its field in the United States. Prior to joining NC State on 1 July 2000 Blan was Chairman and Chief Executive Officer of Juran Institute, Inc., the leading international management consulting, research, and training organization focused on quality management and business excellence, a position he held for 13 years. Prior to joining Juran Institute, Blan was Head of the Quality Theory and Technology Department of AT&T Bell Laboratories (now Lucent Technologies, Bell Labs Innovations). The department focused on applied research in the areas of quality management and technology, reliability and productivity. Blan joined Bell Labs in 1973 after receiving an MS and PhD in Statistics from Florida State University and a BS in Physics from Virginia Tech. For 19 years Blan was also an Adjunct Professor in Columbia University's School of Engineering and Applied Science where he taught graduate courses in quality management and control. He has also been a guest lecturer in clinical quality management at Harvard University. Blan is a Fellow of the American Statistical Association, the American Society for Quality, and the World Academy of Productivity Sciences, and the Royal Society for Art, Manufacturers, and Commerce. He has published over 200 articles and book chapters and co-authored or co-edited five books including *Modern Methods for Quality Control and Improvement* and *Curing Health Care*: *New Strategies for Quality Improvement*. The first edition of *Modern Methods* was named 'Book of the Year' by the Institute of Industrial Engineering and the second edition was published last December. He is the co-editor (with Dr Joseph M. Juran) *of Juran's Quality Handbook*, Fifth Edition, published in March 1999. The Spanish edition of the handbook was published in 2000, and the Chinese edition in 2003. The Japanese edition and paperback edition of *Curing Health Care* were published in 2002.

Ron S. Kenett, PhD is CEO and Senior Partner of *KPA Ltd*., an international management consulting firm and Professor at the University of Torino, Torino, Italy. He has over 25 years of experience in restructuring and improving the competitive position of organizations by integrating statistical methods, process analysis, supporting technologies and modern human resource management systems. As Professor of Management at the State University of New York-Binghamton (1987–1993), he was awarded the General Electric Quality Management Fellowship. For 10 years he served as Director of Statistical Methods for Tadiran Telecommunications Corporation and, previously, as researcher at Bell Laboratories in New Jersey and faculty member at the Department of Statistics, University of Wisconsin-Madison. His 130 publications are on topics in industrial statistics, biostatistics and quality management. Ron is co-author of four books including Modern Industrial Statistics: Design and Control of Quality and Reliability (with S. Zacks), Duxbury Press, 1998, Chinese edition, 2004, Multivariate Quality Control: Theory and Applications (with C. Fuchs), Marcel Dekker Inc., 1998 and Software Process Quality: Management and Control (with E. Baker), Marcel Dekker Inc., 1999. Professor Kenett's PhD is in Mathematics from the Weizmann Institute of Science (1978); he earned a BSc in mathematics with first class honors from Imperial College, London University (1974). Ron is president of ENBIS, the European Network for Business and Industrial Statistics (www.enbis.org).

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