The Implementation of Structural System Analysis and Information Technology to Business Process Re-Engineering

Mahmoud Z. Mistarihi, Ph.D.

Abstract—**Business Process Reengineering provides an efficient and effective change in the way in which work is performed. During the traditional system development life cycle, there are some limitations within the system analysis stage such as poor communication and lack of a common language between the user and the analyst and between the analyst and the designer. To tackle this challenge, this paper presents an integrated methodology of Structural System Analysis and Information Technology.. The real data based on a case study at mix Grill restaurant in Irbid – Jordan is collected then analyzed using the proposed technique to build data and process model. All results demonstrate that the proposed method is both effective and efficient for Business Process Re-Engineering. In fact, it can significantly enhance the business process and thus, gain and sustain the competitive advantage.**

Keywords—**Structural System Analysis (SSA); Business Process Reengineering (BPR); Data flow Diagram (DFD); Competitive advantage.**

I. Motivation

The basic tools and concepts of structured analysis and the transition to structured design will be introduced. The impact of structured analysis on the traditional system development life cycle (SDLC) will be enhanced. In systems analysis process, there are three major problems [1]: Firstly, the analysis process is imprecise, incomplete, and haphazard. Secondly, the inaccurate communication between the analyst and the user on the one hand and the designer or programmer on the other. Thirdly, it doesn't contain logical sense. The core issue of success or failure of any project is how to gain and sustain the competitive advantage. Projects go wrong for a variety of reasons: misunderstanding of user's needs, the dynamic change for user's needs, misunderstanding between analysts and designers and/or between designers and programmers and inflexible design at a global level [2].

The proposed method provides a set of tools designed to solve these problems. It reduces the gap between analysis and design; it produces a system that completed on-time and within budget, meets a stated set of business objectives and

Mahmoud Z. Mistarihi
Yarmouk University
Irbid, Jordan

good system in the sense of being reliable, flexible and maintainable.

II. Introduction and Background

The basic phases for traditional System Development Life (SDLC) is described in *"Fig. 1"*.

Figure 1. Basic phases for traditional System Development Life

Analysis phase is more critical than other activities in SDLC in determining the success of a system. The traditional SDLC analysis have several weaknesses that adversely affect the resulting system [2]. When the analysis ends without: a well-defined standard for the system specification document, the requirements are often incomplete or inaccurate, clear communication between the user and the analyst that results in an accurate, total specification is critical. Without it, there is no assurance that the real needs will be met. The System Specification must bridge the gap from analysis and general design to detailed design and implementation. It establishes the measures of "success" against which the system can be judged throughout the SDLC. It should support the analysis phase in SDLC and it must concentrate on the logical requirements, avoiding the constraints imposed by physical trappings. It is the main communication medium between the analyst and the designer and should be free of any design-bias. Structured analysis is described below in *"Fig. 2"*.

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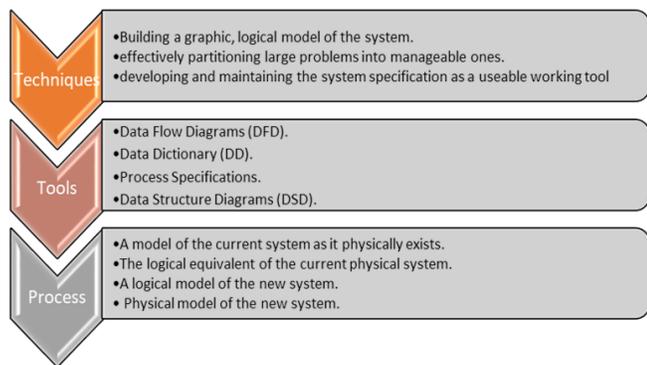
Figure 2. Structured analysis flowchart

III. Proposed Business Process ReengineeringMethodology

The proposed structural system analysis and information technology methodology to Business Process Re-Engineering undergoes the following steps; Specify the new system in such a way that the user, analyst, and designer all have a clear, mutual understanding. The capabilities of the system must be fully specified by defining the data that is needed. The transformations that will be applied, and the performance, security, and controls that are required. Specify the extent to which these processes will be automated and establish a man-machine interface. Moreover, the system specification should communicate these steps in a clear, concise, and precise fashion using target specification by modeling the existing and new proposed physical and logical systems. Then, package the selected alternative.

3.1 The data flow diagram (DFD)

Traditionally, systems are studied from a procedural viewpoint. This approach often results in a narrow, fragmented understanding of the system (flow of control) [3]. The DFD's represents a meaningful change in the way a system is viewed. The use of a DFD provides a more clear and global understanding of the system. (Logical flow of data) [1]. The DFD presents a meaningful model of the system. Advantages of the modeling process [4]: It provides the capability of "seeing" how the system will react when implemented and data is supplied to it, effective analytic tool, leading the analyst to question areas where

understanding is not yet complete or is visibly incorrect, effective communication tool between user and analyst as well as analyst and designer. Moreover, it is an effective tool for partitioning a system and representing the interrelationships between the resulting components. *"Fig. 3"* highlights the DFD process.
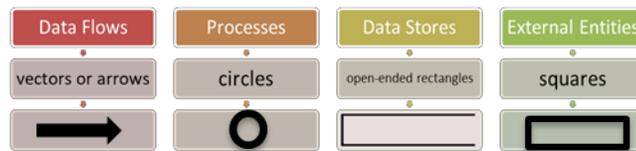
Figure 3. The data flow diagram (DFD) process

How to draw the DFD level zero (starting point) [5]: identifying the net sources and sinks of data, then identifying all data flows between the system and the external entities. Finally drawing a context diagram. Regarding the top-level partitioning of the system(Network): focus should be on the major processes, intermediate data flows and data stores necessary to model the system which transforms the major system inputs to its outputs. To draw the fragmented portions of the DFD (Completed network): identify the existence of processes and data stores but do not label until data flows have been named. Then, label each data flow with a name that is an honest, meaningful, and complete description of its content. After that consideration of control aspects such as loops, decisions, starting, and stopping.

A successful system model is the product of many iterations. With each iteration new insights and understandings are gained. DFD is not easily understood because too much detail is presented in one drawing [6].

3.2 The Data Dictionary (DD)

Meaningful names have been given to each data flow, data store, and process in DFD Network [7]. These names aid in understanding but don't specify the system. The data and the processes must be fully defined, so that users, analysts, and designers have a correct and complete understanding of the system. The Data Dictionary (DD) will contain the definitions of all data referenced in the system and a process specification. The DD is used primarily for reference purposes and to maintain consistency in naming and specifying the characteristics of the data throughout the system [8].

TABLE 1. TYPES OF ENTRIES IN THE DATA DICTIONARY.

Data elements	
• Pieces of data that are not further decomposed.	1) The type of data element: discrete or continuous. 2) The size of length for discrete data, a list of values and meanings. 3) for continuous data, ranges of valid values and typical values 4) Any additional editing information or notes that are necessary.
Data structures • Composed of data elements and other data structures through the use of the relational operators of sequence, selection, and iteration.	1) The composition of the structure in terms of data elements and structures and relational operators that connect them 2) For data flows, information on volume, frequency, peak periods, timing, growth, and other important measurements may be recorded.
Data stores • Groupings of data structures that are temporarily held until needed	1) The composition 2) The organization and order with key data elements identified 3) Quantitative measures similar to those for data flows.

The data definition portion of a typical DD may contain thousands of entries. These entries fall into three types as described in Table 1.The analyst can specify a process in such a way that given a particular set of values for the incoming data flows, exactly one combination of rules applies, resulting in a unique set of values for the outgoing data flows [9].To accomplish this, three tools are introduced: Structured English, that is a restricted vocabulary which uses action-oriented verbs, omits subjects, and uses terms that are reserved or defined in the data dictionary (DD). Secondly, decision tables as excellent analytic tools in situations where the resulting actions depend on the occurrence of one of several complex combinations of independent conditions. Finally, decision trees: graphic representations of policy that are also useful in situations with combinations of several independent conditions. It is an effective way to present the results of a decision table. The DFD's must be further packaged into implementation units or jobs based on: the centralization vs. decentralization of data and processing functions, custom development vs the use of major commercially available application software packages and Separating functions that fall in the same business cycle into separate, cohesive jobs [10].

IV.   Case Study: MixGrill restaurant in Irbid, Jordan

To test the tools and techniques of structured system analysis, a case study was carried out at Mix Grill fast food restaurant in Irbid, Jordan. There was no As-is model to fulfill the restaurant's mission. The proposed method is used to build the "To-Be model" to fully and deeply understand and predict customer needs to gain and sustain the competitive advantage.

To carry on the proposed method, firstly, we start in building database for the information system by collecting data about products, customers, raw materials, suppliers, and other Entities *(Table 2)*. Then create tables representing the collected data.

TABLE 2. BUILDING DATABASE FOR THE INFORMATION SYSTEM

برغر بيكن 5	2.75	20	0	1 برغر, مايونيز علبة 50 غ, كاتشب علبة 50 غ, باربكيو صوص علبة 50 غ, خس, مخلل علبة 50 غ, علب فوم شاندويش.
برغر بالصلصة الإيطالية 6	2.75	20	0	1 برغر, مايونيز علبة 50 غ, كاتشب علبة 50 غ, باربكيو صوص علبة 50 غ, خس, مخلل علبة 50 غ, علب فوم شاندويش.
برغر سبيشل تشيز 7	2.5	20	0	1 جبنة بارميزان, خبز برغر, مايونيز علبة 50 غ, كاتشب علبة 50 غ, باربكيو صوص علبة 50 غ, خس, علب فوم شاندويش.
برغر بيف 65 غ 8	1	10	0	1 قطع بيف 65 غ, جبنة شيدر, خبز برغر, خس, علب فوم شاندويش.
برغر تشيكن 65 غ 9	1	10	0	1 قطع صدر دجاج 65 غ, جبنة شيدر, خبز برغر, مايونيز علبة 50 غ, كاتشب علبة 50 غ, خس, علب فوم شاندويش.
اسكالوب 10	1.25	10	0	1 اسكالوب, جبنة شيدر, خبز برغر, مايونيز علبة 50 غ, كاتشب علبة 50 غ, خس, علب فوم شاندويش.
رويال تشيكن 11	1.25	10	0	1 تندر, جبنة شيدر, مايونيز علبة 50 غ, كاتشب علبة 50 غ, خس, علب فوم شاندويش.
هوت دوغ لحم 12	1.75	15	0	1 نسي, مايونيز علبة 50 غ, كاتشب علبة 50 غ, خردل علبة 50 غ, خس, ذرة علبة 50 غ, زيتون اسود, علب فوم شاندويش.
هوت دوغ دجاج 13	1.75	15	0	1 نسي, مايونيز علبة 50 غ, كاتشب علبة 50 غ, خردل علبة 50 غ, خس, ذرة علبة 50 غ, زيتون اسود, علب فوم شاندويش.
سجق 14	1.75	15	0	1 سجق, جبنة شيدر, خبز فرنسي, مايونيز علبة 50 غ, كاتشب علبة 50 غ, خردل علبة 50 غ, علب فوم شاندويش.
دجاج مسحب 15	1.75	10	0	1 قطع صدر دجاج 150 غ, خبز شراك, مايونيز علبة 50 غ, خس, مخلل علبة 50 غ, علب فوم شاندويش.
شيش 16	1.5	10	0	1 قطع صدر دجاج 150 غ, جبنة شيدر, مايونيز علبة 50 غ, خس, علب فوم شاندويش.
ايطالي دجاج 17	1.75	10	0	1 قطع صدر دجاج 150 غ, جبنة بارميزان, خبز شراك, مايونيز علبة 50 غ, خس, علب فوم شاندويش.
دجاج ماليزي 18	1.75	10	0	1 قطع صدر دجاج 150 غ, جبنة شيدر, خبز شراك, خس, مخلل علبة 50 غ, علب فوم شاندويش.
دجاج بالخردل 19	1.75	10	0	1 قطع صدر دجاج 150 غ, جبنة موزاريلا, خبز شراك, خردل علبة 50 غ, خس, علب فوم شاندويش.
دجاج فرنسي 20	1.75	10	0	1 قطع صدر دجاج 150 غ, خبز شراك, مايونيز علبة 50 غ, خس, زيتون اسود, علب فوم شاندويش, فطر 50 غ
دجاج تندوري 21	1.75	10	0	1 قطع صدر دجاج 150 غ, جبنة شيدر, خبز شراك, مايونيز علبة 50 غ, كاتشب علبة 50 غ, خس, علب فوم شاندويش.
فاهيتا 22	1.5	10	0	1 قطع صدر دجاج 150 غ, جبنة موزاريلا, مايونيز علبة 50 غ, خس, ذرة علبة 50 غ, زيتون اسود, علب فوم شاندويش.
ستيك لحم 23	1.5	10	0	1 قطع بيف 150 غ, جبنة شيدر, خبز فرنسي, مايونيز علبة 50 غ, خردل علبة 50 غ, خس, علب فوم شاندويش.
ستيك دجاج 24	1.5	10	0	1 قطع صدر دجاج 150 غ, جبنة شيدر, خبز فرنسي, مايونيز علبة 50 غ, خس, علب فوم شاندويش.

Material No	Material Name	Quantity	Cost	Expiration D
1	قطع بيف 150 غ	50	0.8	6/20/2017
2	قطع بيف 65 غ	75	0.3	6/15/2017
3	قطع صدر دجاج 150 غ	50	0.65	4/28/2017
4	قطع صدر دجاج 65 غ	75	0.3	4/24/2017
5	زنجر	50	0.4	6/2/2017
6	تندر	40	0.4	8/1/2017
7	هوت دوغ دجاج	200	0.6	9/22/2017
8	هوت دوغ لحم	100	0.4	3/18/2017
9	سجق	15	0.4	3/18/2017
10	اسكالوب	35	0.4	3/18/2017
11	جبنة شيدر	250	0.05	3/18/2017
12	جبنة موزاريلا	250	0.05	3/18/2017
13	جبنة قشقوان	250	0.1	3/18/2017
14	جبنة بارميزان	150	0.1	6/10/2017
15	خبز شراك	50	0.05	12/27/2016
16	خبز فرنسي	40	0.07	3/18/2017

133	برغر بيف 150 غ, علبة بطاطا, كوكا كولا 330 مل 16
134	برغر تشيكن 150 غ, دايو 330 مل
135	هوت دوغ لحم 23
136	شيش, فانتا 330 مل, ماء كبير 12
137	اسكالوب, علبة بطاطا تشيز, كوكا كولا 330 مل 19
138	ايطالي دجاج, دايو 330 مل, ماء صغير 19
139	سحب, كوكا كولا 330 مل, فانتا 330 مل, دايو 330 مل 14
140	برغر بيف 150 غ, دايو 330 مل 44
141	اسكالوب, فانتا 330 مل
142	هوت دوغ دجاج, دايو 330 مل 19
143	زنجر, شاورما عادي 20
144	دبل, كوكا كولا 330 مل, فانتا 330 مل, دايو 330 مل 18
145	شاورما سوبر, فانتا 330 مل 28
146	شيش وكباب, كوكا كولا 330 مل
147	شيش, دايو 330 مل 17
148	دجاج فرنسي 21
149	اسكالوب, دايو 330 مل 5

Supplier No	supplier Name	Distance	lead time	phone	materials
1	مخابز الطواحين	3 كم	24 ساعة	796216522	خبز شراك, خبز فرنسي, خبز برغر
2	مجمدات نبيل	15 كم	2 يوم	791313735	هوت دوغ دجاج, هوت دوغ لحم, سجق, اسكالوب
3	ملحمة اللنجي	1.5 كم	3 يوم	772316522	شيدر, جبنة موزاريلا, جبنة قشقوان, جبنة بارميزان
4	شركة افق السماء	5 كم	2 يوم	796122646	غ, زيتون اسود, مخلل علبة 50 غ, فطر 50 غ, بطاطا
5	شركة الصباحين	6 كم	3 اسبوع	789243312	فوم بطاطا, علب فوم شاورما, علب فوم شاندويش
6	اسواق الضاحية	4 كم	2 يوم	797872246	خس, زيتون اسود, عصير برتقال

Now, the next step is data modeling to create relationships between tables as described in *"Fig. 4''*
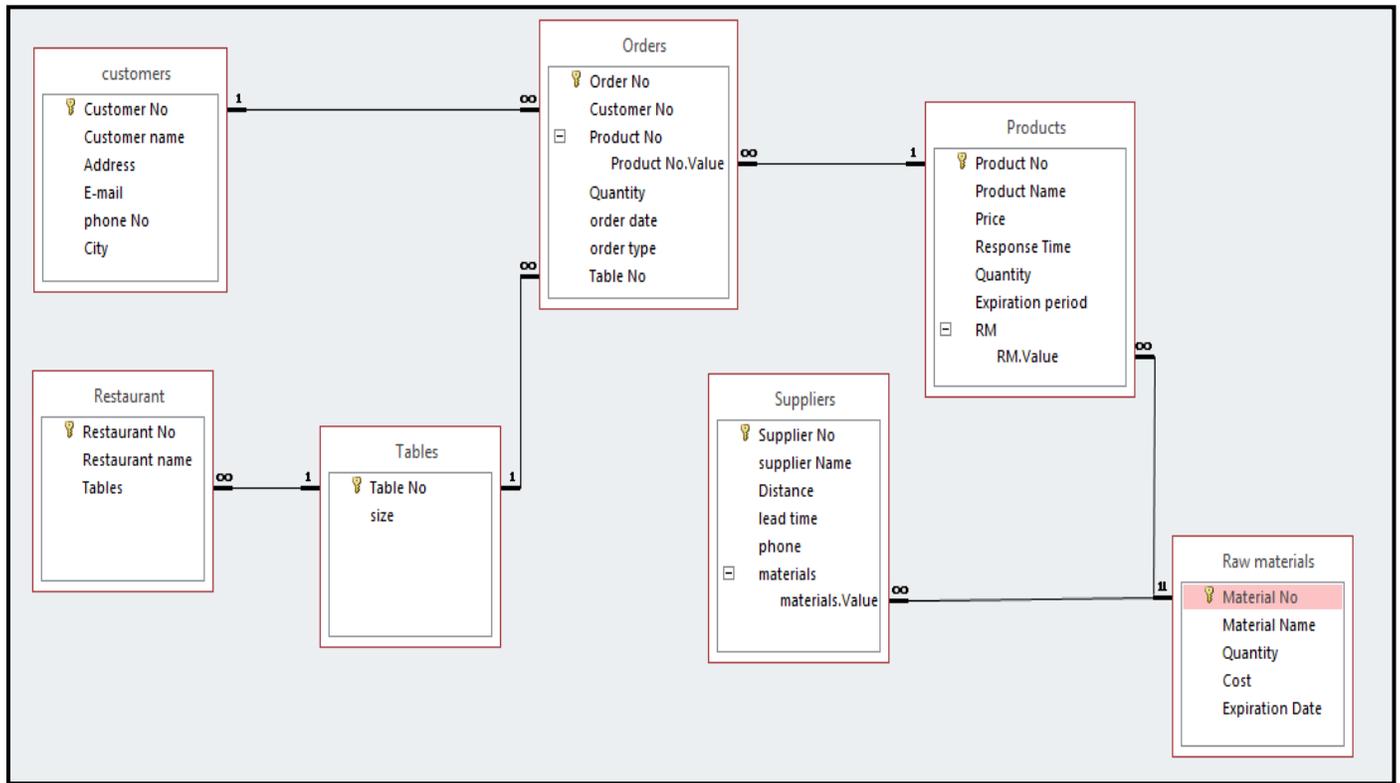

Figure 4. Data modeling process.

Then, create queries and forms as described in *(Table 3).*

TABLE 3. CREATING QUERIES AND FORMS FOR THE INFORMATION SYSTE

Figure 5. Data Flow Diagram (DFD) for ordering and delivering process.
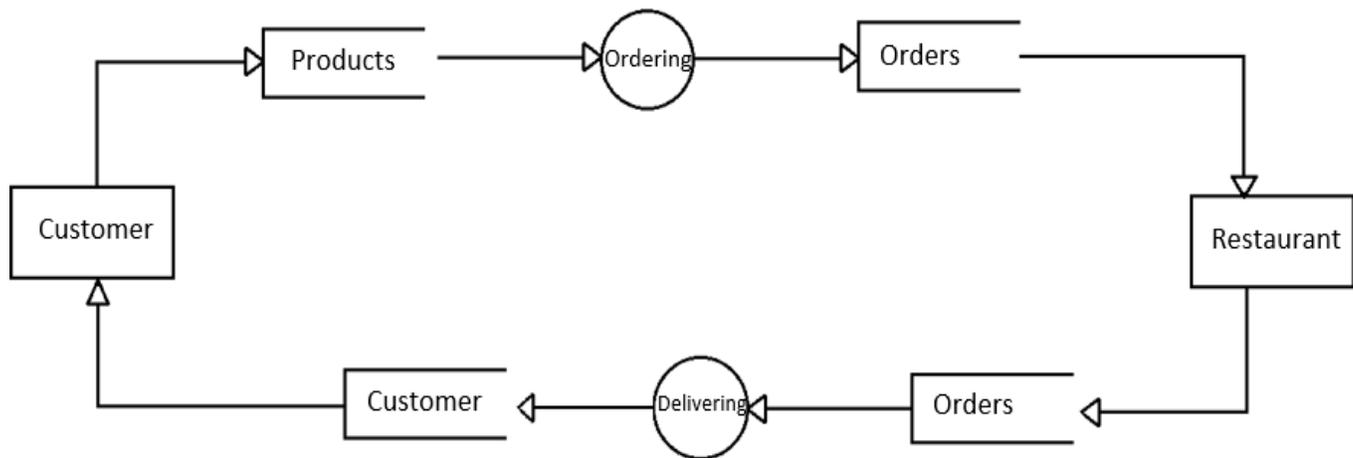
Figure 6. Data dictionary (DD) for ordering and delivering process.

Now, we will use the SSA tools to enhance the business process by matching the right structured design (process model) with the right structured analysis via Data Flow Diagram (DFD) for ordering and delivering process *"Fig. 5"* and using Data Dictionary *"Fig. 6"*.

Now, the ordering and delivering process models (logical model) are ready to give it to designer (IT) to convert it to (physical model). Results of the case study show that the proposed methodology enhances the business process by understanding the customer needs in the dynamic environment and it builds the right process model by eliminating the misunderstanding between designer (IT) and analysts (IS) and it helped in creating flexible design for global level.

V.   Conclusion

The core issue of success or failure of any project depends mainly on data and process modeling to gain and sustain the competitive advantage. Projects go wrong for a variety of reasons, mainly the misunderstanding of the user's needs within a dynamic environment. In this paper, a case study at mix Grill restaurant in Irbid – Jordan is presented of the incorporation of Structural System Analysis (SSA) and Information Technology (IT) in business process re-engineering. All results recommend that the proposed method is both effective and efficient for the reengineered To-Be process. In fact, it can significantly enhance the business process in terms of throughput rate, latency and customer satisfaction. Thus, gain and sustain the competitive advantage.

Acknowledgment

References

[1] Mchael Hammer, "Reengineering work: don't automate, obliterate", Harvard Business Review, July-August, 1990.

[2] M. Laguna and J. Marklund, "Business Process Modeling, Simulation and Design", Prentice Hall, March 2004.

[3] Michael Hammer and James Champy, Reengineering the Corporation, Nicolas Brealey, London, 1993.

[4] Gary Bom, Process Management to Quality Improvement: the way to design, document and re-engineer business systems, John Wiley & Sons, Chichester, 1994.

[5] "Business Process Reengineering," Technology Park Malaysia (TPM), 2015, [Online]http://www.iscistech.com/Webpages/BusinessProcessReengi neering.aspx.

[6] Mohsen Attaran, Sharmin Attaran. The rebirth of re-engineering: Business Process Management Journal, 2004, Volume:10 Issue:4 Page:415 – 429.

[7] Chiwoon Cho, Nam Wook Cho. Design of a BPR-Based Information Strategy Planning (ISP). Computational Science and Its Applications – ICCSA 2005, Volume 3482/2005.

[8] Malhotra, Y., Business process redesign: an overview. IEEE Engineering Management Review, 1998. 26: p. 27-31.

[9] Davenport, T.H., Process innovation: reengineering work through information technology1993: Harvard Business Press.

[10] Hammer, M., Reengineering work: don't automate, obliterate. Harvard business review, 1990. 68(4): p. 104-112.

Mahmoud Z. Mistarihi:

Mahmoud Z. Mistarihi is currently an assistant professor in Industrial Engineering department, Hijjawi faculty of Engineering Technology at Yarmouk University, Jordan. He earned B.S. in Applied Mathematics and Statistics from Mutah University, Jordan, Masters in Pure Mathematics from Mutah University, Jordan, Strategic studies Diploma from Royal Military Academy Sandhurst, camberley, UK and PhD in Industrial Engineering and Management from Oklahoma State University, USA. Dr. Mistarihi has taught courses in engineering economics, ergonomics, supply chain modeming, Operation Research and manufacturing information systems. His research interests include monitoring and diagnosis of complex systems, supply chain engineering, optimization, system identification and ergonomics. Dr. Mistarihi serves as assistant director of Jordanian military factories. He is a member of the Jordan Engineers Association (JEA), and IIE.