

# Uncertain Supply Chain Management

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## Validating the operational flexibility dimensions in the medical service sectors

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### ABSTRACT

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This paper examines the health operations flexibility dimensions in the United Arab Emirate in the healthcare sector by employing Structural Equation Modeling (SEM) approaches. The study also attempts to determine the numbers for the operational flexibility dimensions which will help the researchers in future find healthcare operational flexibility dimensions valid and reliable. A model consisting of two constructs of operations flexibility structures: external flexibility and internal robustness is examined to measure health operations flexibility elements in service sectors. Respondents are the health leaders (managers, middle manager, top manager and others) who were working in health service sectors in the United Arab Emirate. The underlying constructs of operations flexibility are empirically verified and validated through Reliability Analysis Procedure, Exploratory Factor Analysis (EFA), First and Second Confirmatory Factor Analysis, and Construct Validity Procedures, Structural Equation Modeling (SEM) was employed to test the model, drawing on a sample of 250. The findings revealed that the model of the UAE health service sector consists of two latent's operations flexibility dimensions namely external flexibility and internal robustness, each dimension consisting of four items. Further research should be considered to validate these findings in the other firms. The two dimensions of health operations flexibility represent a valid instrument to measure the operations flexibility in the services sector in the United Arab Emirate. This research is important for one to understand the main topics of health operations flexibility in the health services sector.

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## 1. Introduction

Flexibility in operations, organizations can successfully return to their customers' needs and changing status will become a strategic modest advantage for organizations (Slack, 2005; Qin et al., 2015; Halemane & Janszen, 2004). Moreover, the ability must be elastic with the needs of the client (AlTaweel & Al-Hawary, 2021). Thus, customer service can direct organizations to emphasis on customer-centric schemes (Eldahamsheh et al., 2021). Consequently, customers get more value for their money in the long term (Tariq et al., 2022a, 2022b). Identifying the importance of these structures, studies are desired to assess the bond that can provide guidance to managers to reach to discrete decisions. Previous literature discusses flexibility often in the industrial environment. For example, Alolayyan et al. (2013) proposed that a flexible industrial system covers a range of industrialized activities including machining, welding, manufacturing, assembly and others. As a result, it is evident

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that flows of raw materials to suppliers and after-sale provisions as key aspects of manufacturing represent a core theme of tractability. However, marketplace rivalry is changing, so as customer demands, need efficiency, high quality, incredibly supply production and service (Song et al., 2018). Flexibility or lithe is vital to encounter various unpredicted changes in customer requirements. Flexibility supports organizations to accomplish swift deviations efficiently and effectively. Flexible solutions in manufacturing typically involve minimizing the number of people, enhancing machine utilization, improving process control, and decreasing both inventory work and final product inventory (Aityassine et al., 2021; Al-Alwan et al., 2022; AlHamad et al., 2022; Bernardes & Hanna, 2009).

The important operations objective is the method flexibility, especially during unanticipated changes in the business environment (Ishfaq, 2012). Political and technological improvements change the overall philosophy of acclimating flexibility in service and manufacturing in the light of economics (Zhang et al., 2002; Harvey et al., 1997). Organizations need more struggle to meet internal and external customer satisfaction, via their good enough strategies and effective plans to create greater flexibility inside the system (Nakhla, 1995; Qin et al., 2015). The flexibility of operations within the organizations related to services depends on their managers for fundamental changes in employees' behavior, conduct, attitudes, structure, operations, work systems and other circumstances required to acquire the keen results of the operational flexibility program. In all aspects, achieving the principles of such a program in firms entails a hard obligation from top management, and is extremely dependent on numerous factors such as raw materials, strategic planning, supply chains, as well as leadership. This research is conducted to realize scopes and features of operational flexibility in the service sector with the intention of improving its operational service performance. Likewise, the results of this research might enrich the operational performance of the health sector through promoting operational flexibility (Irvani et al., 2005).

## 2. Concept of operations flexibility and flexibility

Alolayyan et al. (2013) suggested factors influencing the operations management i.e. quality of customer service and the authenticity of global competition, quick expansion of progressive technology, scarcity of operating means, cost dares, constant growth of the services sector and lastly social responsibilities. TQM as a crucial pillar of operations management is influenced by these factors. Consequently, both executive management and TQM are significantly related, which means that erroneous applications of TQM result in negative influences on operations management. For Carlsson (1989), dynamic changes can be managed effectively and efficiently using flexibility. Strategies, in this regard, depended on activities such as employee downsizing, eliminating unnecessary activities from work processes and end product inventory, boosting process controls, and increasing machine utilization. In fact, flexibility leads to positive effects of production processes, however, employee downsizing gives rise to societal problems such as unemployment.

Manufacturing strategy is a function of at least two central methods of flexibility: responsiveness in turbulent environments and influence on performance standards of organizations (Correa & Gianesia, 1994). The authors found the flexibility to adapt and adopt the process due to changes in customer needs and the manufacturing process, or possibly due to changes in resource supply. Flexibility thus encompasses all operations, particularly once such fluctuations affect customers. Therefore, organizations should respond to any deviations that affect client satisfaction. The goal of flexibility and the ability to deal with impacts efficiently, through methods used to control unexpected changes, decrease the impacts of change which the organization should handle, developing practical flexibility to cope with the effects of unintentional fluctuations when they happen. Additionally, Correa and Gianesia (1994) advocated numerous features for the control filter, including monitoring, prediction, standardizing, retention, seizure, tabulation, promotion and replacement through delegation, subcontracting, focus, coordination, and integration. If unforeseen changes enter the control filter for whatever reason, the operation flexibility must be addressed through the forms of service procedures.

Seven sorts of service operation flexibility were suggested by Correa and Gianesia (1994)

- 1) Flexible design: Ability to provide new service.
- 2) Flexibility package: the ability to provide variety services within a period.
- 3) Delivery location services: The ability to provide service in a variety of places.
- 4) Flexible delivery time: Ability to expect delivery of services to the condition.
- 5) Volume flexibility: the ability to change the levels of services output.
- 6) Flexible durability, capability survives successfully in spite of ups and downs affecting inputs and processes.
- 7) Flexible recovery of customers: the capacity to retain customers when the things went incorrect. The outcome of unintended changes verves in the way of clouds, disturbing the organization only, and affects the entire market.

Harvey et al. (1997) suggested three key conditions of services and service delivery processes, which are:

- 1) In general, a service includes at least one type of customer contact.
- 2) Increased demand of customers' requires assembling services to yield specific outcomes and delivery in harmony with its cycle of activity.
- 3) Services are usually used up when created.

The authors find the source of variation, either inside and externally. External market differences are caused by competition, but internal variation is caused by features such as organizational structure, managerial processes, and product and process design. It was acknowledged that the essential quality that allows businesses to cope with environmental oscillations is organizational flexibility, because it makes the organization more sensitive to change. This sensitive response allows the business to have a flexible strategic organizational capability and hence retain acceptable performance without incurring excessive reorganization expenses (Verdu & Gomez-Gras, 2009).

There are four types of management flexibility adopted from Verdu and Gómez-Gras (2009), which are strategic flexibility, structural flexibility, operational flexibility as well as internal and external flexibility.

**Strategic flexibility** refers to a firm's ability to cope with economic crises and competitive environments; hence, strategic flexibility helps the firm develop novel positions of learning generation, innovation, adaptation, and durability enhancement. On the other hand, structural flexibility is more focused on individuals, often informal, as well as decentralized, so that it emphasizes on personnel management, especially managerial practices that can unswervingly influence structural flexibility such as fellowship, rewards, contribution, job design and training, employees have a major influence on performance particularly those who have parity and be able to do various functions in enterprises. Flexible work methods, such as time management, improve firms' performance. Operational flexibility represents a firm's ability to deal with unanticipated fluctuations based on the organizational structures or existing goals, as well as changes in the environment. It does not imply any change in the firm's interaction with the environment. Operating flexibility affects both cost and speed of the operational response itself and is often reversible for short-term changes such as hourly and daily operations. **Internal and external flexibility:** internal flexibility refers to organizations' ability to acclimatize to its environment, whilst external flexibility relates to the effect of the environment and its susceptibility. Changes of the regulatory environment can also be achieved by strategies such as communication, innovation, and advertising. Internal and external flexibility is linked to abusive or defensive behavior and, respectively, to regulation.

### 3. Conceptual model

Fig. 1 summarizes the conceptual research model. The operations flexibility constructs are illustrated in this conceptual model. The model begins with operations flexibility, which consists of internal robustness and outward flexibility. Each of these two dimensions has five indicators.

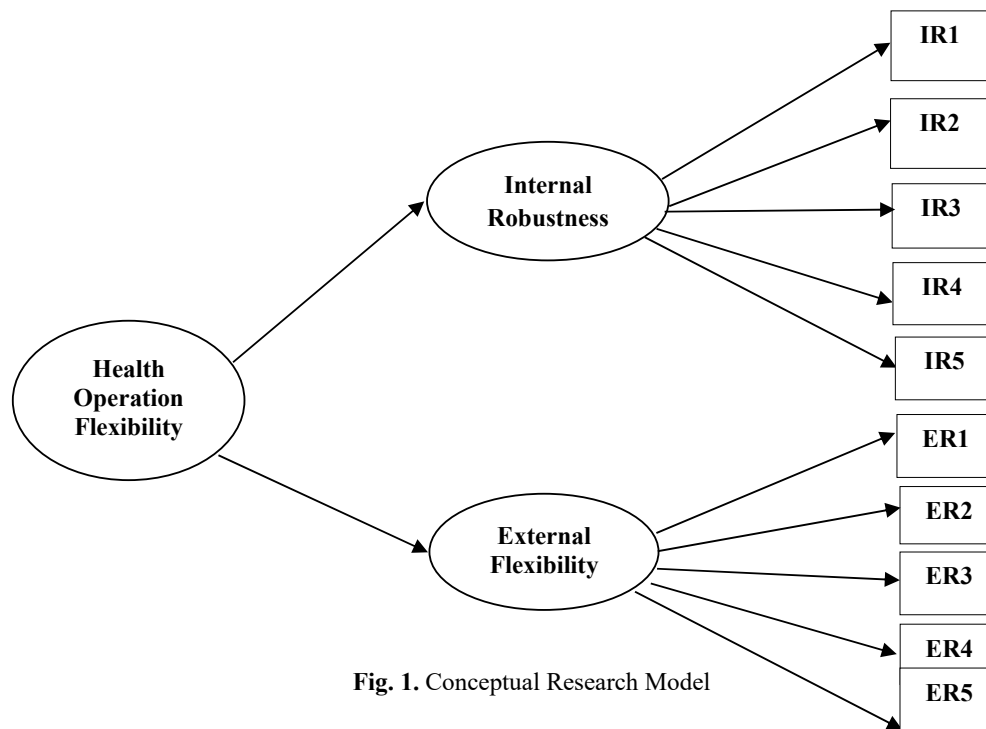


Fig. 1. Conceptual Research Model

### 3. Methodology

#### 3.1 Instrument

A quantitative research method was conducted to identify the dimensions of the independent variable (health operations flexibility) in medical services organisations. The study's questionnaire was established to collect data from respondents

(managers, middle manager, top managers and the others). The survey instrument is composed of questionnaires relating to operations flexibility. The operations definitions were adopted from Idris et al. (2010). The questionnaire encompasses ten items measured using a 7-point Likert scale ranging from 1 (least important) to 7 (very important).

### 3.2 Sampling and data collection procedure

A random sampling was followed to determine the members of the research sample. The total respondents were 250 employees (managers, middle manager, top manager and others) from different medical services sectors.

### 3.3 Reliability

The degree to which outcomes are dependable throughout time is characterized as reliability, and it serves as the finest picture of the overall population in investigation (Joppe, 2000). A study tool can be classified as a trustworthy tool if the results of a study can be replicated using the same technique as well as the instrument consistency over time (Kirk & Miller, 1986; Golafshani, 2003). As a result, the constructs of the research instrument have the following reliability scores:

**Table 1**  
Results of operations flexibility instrument reliability

Factors	Items	Cronbach's alpha
External Flexibility	5	.717
Internal Robustness	5	.871
<b>Operations Flexibility</b>	10	.782

Table 1 shows that the dependability scores of operations flexibility are quite significant. All values of Cronbach's alpha were higher than 0.7 (Nunnally & Bernstein, 1994). The exterior flexibility constructs (.717) and the internal robustness construct (.717).

## 4. Data analysis and results

### 4.1 The Exploratory Factor Analysis (EFA)

EFA analysis utilizing the principle component extraction method with Promax rotation to figure out what factors/dimensions contributed to operating flexibility. To assess the number of factors to keep for operation flexibility, Kaiser's criterion (eigenvalues > 1) in conjunction factor loadings and screen plot (Pallant, 2007) were extracted. EFA results in Table 2 revealed that external flexibility assessed by five items and internal robustness evaluated using four items represent two key components of operational flexibility. Table 2, 3, and 4 depict the findings of the EFA.

**Table 2**  
Results of EFA

	Component	
	1	2
FPF3	0.779	
FPF4	0.829	
FPF1	0.895	
FPF2	0.734	
FPSR5		
FPF5		
FPSR4		0.826
FPSR3		0.759
FPSR1		0.764
FPSR2		0.692

Extraction Method: Principal Component Analysis  
Rotation Method: Promax with Kaiser Normalization  
Rotation converged in 3 iterations

**Table 3**  
KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.766
	Approx. Chi-Square	829.999
Bartlett's Test of Sphericity	Df	45.000
	Sig.	.000

**Table 4**  
Total Variance Explained

Component	Initial Eigenvalues			Total
	Total	% of Variance	Cumulative %	
1	3.221	32.212	32.212	3.308
2	2.073	20.727	52.939	2.217
3	1.191	11.907	64.846	
4	.836	8.359	73.205	
5	.660	6.602	79.807	
6	.521	5.209	85.016	
7	.491	4.913	89.929	
8	.411	4.114	94.043	
9	.328	3.282	97.326	
10	.267	2.674	100.000	

Extraction Method: Principal Component Analysis

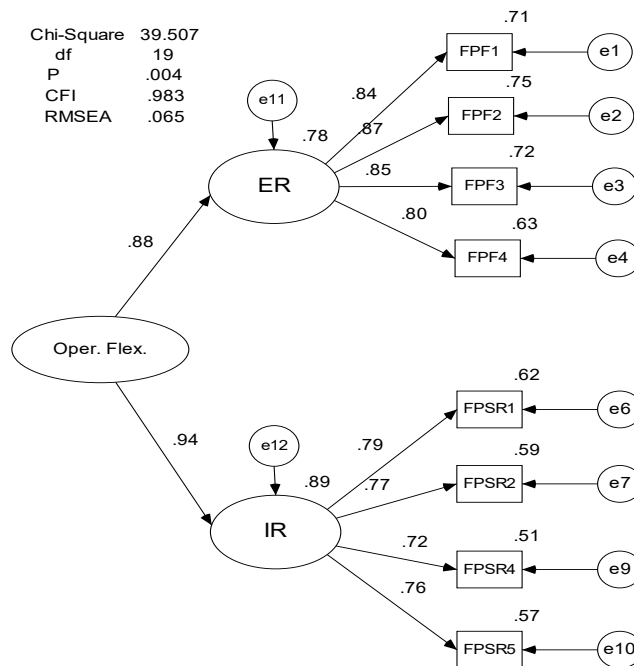
4.2 Research structural model

The results of model fit statistics are summarized in Table 5. The goodness of fit information in Table 5 approves the model's suitability, as the derived statistics are within the recommended ranges for a decent model-data fit. Chi-square (Cmin/df) is less than 3, which is acceptable (Bollen, 1989). RMSEA is less than .08, and CFI & TLI is higher than 0.9 (Byrne, 2010).

**Table 5**  
Results of model fit statistics

Model	X <sup>2</sup>	df	P	Cmin/ df	RMSEA	CFI	TLI
Fit Statistics	39.507	19	.004	3.0793	.065	.983	.966

All of the model's factor loadings are practically feasible and statistically significant, implying loading coefficients varying from .72 to .87, well above the recommended threshold of 0.6 and with no objectionable estimates (Byrne, 2010). The Critical Ratio (CR) values from each of the inter-variable connections show that the links between the three components (operation flexibility and cost; operation flexibility and customer focus; and customer focus and cost) are significant (Byrne, 2010). at an alpha level of .05. larger than 1.96 (absolute value) (Kline, 2011).



**Fig. 2.** Research structural model

## 5. Discussion

Based on literature, Health Service Operation Flexibility HSOF involves two elements: External Flexibility (EF) and Internal Robustness (IE). The results confirm our prospects. It is found that the elasticity of processes could be allocated into external flexibility and internal heftiness from the data (Idris et al., 2010; Harvey et al., 1997). External flexibility and internal durability are replicated by four measures each (eight in total), and managers should consider such factors to complete process flexibility.

We have suggested in the literature that operations flexibility is made up of two components: outward flexibility and internal robustness. It is typical to drop some items based on modifications index when confirming the indications that have an impact on the instrument. The original number of items for the flexibility of health-care operations, which encompassed both internal and external flexibility, was ten. After cutting the hypothesized model because of CFA, eight components remained that were of practical significance and clearly characterized and clarified flexibility of service operations. Two entries were removed from the list. Although the dependability index was initially appropriate for both FPSR 3 (internal robustness) and FPF5 (external flexibility), it had to be eliminated to retain the model's acceptable goodness of fit. We expect respondents to be perplexed by this item because it is negatively worded. As a result, the remaining items might best explain the re-specified model's health service operating flexibility. The findings support our hypothesis revealing that health-care operations flexibility may be separated into two categories (outward flexibility and internal robustness) as suggested by previous works (e.g., Harvey et al. 1997; Idris et al. 2010; Verdu-Jovre et al. 2004;).

In order to gain flexibility within health operations, supervisors should prioritize variables. The item “We have just been able to offer new, unique, and creative health services to outpatients” for example, illustrates the necessity for health service sectors to mature new services with added-value to patients. Private hospitals could launch a new health service with cutting-edge technology. “We were able to include several characteristics of health care into alternative packages that were desired by patients”, says item 2. The competition for health tourism in the Gulf Cooperation Council region has increased. Several private hospitals in the UAE and other GCC nations have begun offering a package of “health tourism”, in which customers are provided discounted pricing for bundled health treatments.

Based on the findings, we have developed a validated instrument for the health-care industry to utilize as a self-assessment tool to determine their operational flexibility. Companies should be better equipped to service their clients if they have these capabilities, as mentioned in the literature. Flexible medical centers will be better able to deal with fluctuating market demand in this way (da Silveira, 2006). One of the study's weaknesses is that some respondents were chosen in a non-random way because the sampling frame for the respected health service sectors was unavailable. We recognize this gap but also there is a need to indicate that there must be some real-world solutions. A key challenge of carrying out survey-based research in developing countries is the low degree of respondents' cooperation.

## 6. Conclusion

Given the multiplicity and impact of process flexibility, health organizations must form a comprehensive and robust relationship between the flexibility of internal processes and the flexibility of external processes. This strong association will help Health organizations overcome unpredicted changes based on strategies of operational flexibility that will ultimately result in operational efficiency.

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