A Study of the Causes of Wars between the Government and the Shiites of Yemen Based on "Fuzzy Cognitive Maps"

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The first round of the conflict between the Yemeni government and the Shiites started in 2004 and since then, has gone through six stages. These conflicts, which first began as minor skirmishes, gradually took on new dimensions and increased in intensity and extensiveness in such a way that at the sixth stage of the war, the Saudi Arabian air force and the United States officially entered the battle, each under its own pretext. The purpose of this research paper is twofold: first, to study the reasons and roots of these wars and second, to use "fuzzy models and maps" in the analysis of the factors which play a role in this crisis.

Keywords: Yemen Crisis, Zaidi Shiites, Houthis, Civil war, Religious differences, Zaidis' revival, Fuzzy logic, Fuzzy cognitive map (FCM)

1. INTRODUCTION

Yemen, as one of the oldest and most important centers of monotheism and Islam in the Middle Eastern and North African region, borders with Saudi Arabia to the north, the Gulf of Eden to the south, Oman to the East, and the Red Sea to the west. It has an area of 527,970 km² and a population of about 25 million people. Its official religion is Islam and the followers of the Shafi'i school of Sunni Islam and the Zaidi school of Shiite Islam constitute the religious majority of the country (CIA 2005).

In the wake of the December 1989 agreement on the unification of South and North Yemens, the two Yemens were unified. The Republic of Yemen was thus established in 22 May 1990. South Yemen had been a colony under the British rule since 1838 and gained its independence on 30 November 1967. South Yemen then became the People's Republic of Yemen and joined the Eastern camp within the bipolar system during the Cold War period. North Yemen, which was dominated by the Ottoman Empire until 1918, came under the control of Zaidi imams after World War I and the collapse of the empire. It then fell into the hands of the revolutionaries in 1962, under the influence of the wave of Arab unity in Egypt and with the help of that country's army and through a military coup.

Yemen has a strategic position within the region because it overlooks the strait of Bab el-Mandeb and its ability to control it through the Perim Island, which divides the strait into two waterways, and also because of other important islands as Socotra. This is why the country has always been in the center of the attention of international, as well as regional, powers

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(Ministry of Foriegn Affiars of Iran 1997).

The first Zaidi Shiite government was established in Yemen by Yahia Ibn al-Hassan Ibn al-Qasim al-Hadi, entitled "al-Imam al-Hadi ila al-Haqq" in 284 A.H. /897 A.D. That government lasted, continuously and intermittently, for almost one thousand years, up to the September 1962 Revolution. The Zaidi Shiites mostly reside in the northern provinces of the country. The Sa'dah province is the main center of Shiite presence in the history of Yemen (Ahmad 1996).

With the collapse of the Zaidi system of Imams and in the period from 1962 to the unification of the two Yemens in 1990, the Salafis, who emerged in the second half of the 20th century and regarded themselves as the forerunners of the genuine Islam, could penetrate the Yemeni society and attract followers among the Shafi'i Sunnis and the Zaidi Shiites, while everybody was aware of the Salafis' hostility toward Zaidis' Shiite beliefs. Since the early 1970s, Allamah Sayyid Badruddin al-Houthi, one of the most well-known Zaidi clerics of Yemen, along with a number of other clerics who found their Shiite identity being threatened by the Wahhabis and the Salafis, called for a revival of the Zaidi community. He made some efforts in this respect (ICG 2009).

These efforts were mostly in the form of religious propagation, publication of books, setting up libraries and organizing courses for teaching of the Qur'an and its exegesis. Isam Imad, the speaker of the Yemeni Council of the Shiites, believes that the victory of the Islamic Revolution in Iran with the leadership of his Excellency Imam Khomeini in the first decade of the 15th century A.H., led to the moral invigoration of the Shiites in Yemen, at the face of their Salafi rivals.

With the unification of the two Yemens and, subsequently, the establishment of a multi-party system in the country, the Zaidi revivalists found another way to express their claims and achieve their objectives. Sayyid Husain Badruddin al-Houthi, the son of Allamah Sayyid Badruddin, chose the "al-Haqq" party and the "al-Shabab al-Mu'min" group. Within the framework of this party, he and Sheikh Abdullah al-Razami win two seats in the parliament in the first parliamentary elections of 1993, representing the Sa'dah province for four years (ICG 2009).

In 1997, due to the differences which arose between the high ranking members of "al-Haqq" party, Sayyid Husain al-Houthi left the party and concentrated his efforts on religious propagation and the "al-Shabab al-Mu'min" group. These efforts included reviving the Shiite religious rituals and ceremonies, such as the Ghadir feast and the Ashura ceremonies. He also taught courses on teaching the Quran and its exegesis in the mosques (ibid.).

In the aftermath of the September 11 incident in 2001, the U.S. launched its war against terrorism and subsequently attacked Afghanistan and Iraq. The Yemeni government declared its alliance with the U.S. and emphasized its cooperation. In response, the members of "al-Shabab al-Mu'min" shouted slogans of "Allahu-Akbar, Allahu-Akbar, Allahu-Akbar, al-mawtu li-Amrica, al-mawtu li-israel, al-la'natu 'alal-yahud, al-nasru lil-Islam" in the mosques. They continued to do so after the obligatory daily prayers (ibid.). It did not take long for this slogan to gain popularity among the general public. The Yemeni government, however, took a stance against the slogan. The government felt threatened by such expression of hatred and antipathy toward the U.S. and the Israel. The government thus ordered the prosecution and arrest of all of those who shouted such slogans (Thabit 2004).

As will be discussed later, the continued crisis and conflict between the government and the Shiites in northern Yemen began in 2004 and went through six stages until 2006. Each specialist analyzed or described the crisis based on his or her own mindset and ideological

orientation; some analyses, influenced by the media propaganda and their guidelines, focused on one or two factors, and ignored the other factors and the magnitude of their influence on the crisis. The authors of this paper believe that the factors that caused and sustained the crisis, can be identified. The purpose of this research is to assess the roots of the crisis as recognized by the experts using a tool called "fuzzy cognitive maps", and to demonstrate which one of these factors played a greater role in the continuation of the crisis. For example, one may consider the ideological differences between the Shiites and the Salafis as the main cause of the crisis, while the other may focus on the economic aspects such as poverty, an underdeveloped economy, and the lack of fair distribution of wealth. It is difficult to say which of these arguments are more convincing. However, if experts from these two schools of thought are asked to choose the more influential factor, both will argue that his or her own approach is more plausible than the other. Now, let us assume the position of a decision-maker. Which approach must one choose in order to help resolve the crisis? Fuzzy cognitive maps are a tool by which one can assess the level of influence of all of the recognized factors. It enables the decision-maker to define his policy based on a greater awareness of the crisis and expert opinions. This research introduces fuzzy cognitive maps as an effective method of analysis. With the help of fuzzy cognitive maps, the researcher can accurately determine the direction of each factor's influence.

Fuzzy cognitive maps act on the basis of the fuzzy theory, which was initially introduced by Lotfi Zadeh in 1965. According to this theory, ambiguity is a natural attribute of science. Zadeh believed that it is imperative to construct such models that depict ambiguity as a part of a phenomenon. In the Aristotelian logic, there is a correct-incorrect categorization. Every factor, which has an effect on a phenomenon, is either correct or incorrect. According to the Aristotelian logic, the statement "The weather is cold" does not basically determine the extent of weather's coldness, because the extent of weather's coldness varies for different persons. However, in the fuzzy logic, there are statements which are partly correct and partly incorrect. For example, the above statement is fuzzy in nature, the correctness of which is sometimes low, and sometimes high, and this statement is sometimes always correct, sometimes always incorrect, and sometimes correct to some extent (Smithson 2006).

Now that we understood the purpose and the method, let us turn to the descriptive study of the crisis of conflict between the government and the Shiites of Yemen, and what has happened since 2004 until the end of the sixth stage of the war.

2. THE WARS BETWEEN THE YEMENI GOVERNMENT AND THE SHIITES OF THE COUNTRY

2.1. The First War

On 18 June 2004, during bouts of clashes between members of the "Al-Shabab Al-mo'men" and the police, three policemen were killed. Following this incident, the governor of "Saada", issued arrest warrants of Sayed Hossein Alhusi and other members of the group. After hiding out for three months resisting the authorities, he was killed on September 10 in a shelter in the "Marran" mountains, 30 km southwest of Saada. Before dying, he declared his and other members of group's adherence to the system, in a letter dated June 26, to Ali Abdullah Salih, President of Yemen, who has been ruling the country for 32 years since 1978. In the letter, he spoke of the Yemeni government's cooperation with the United States, and

argued that Saudi Arabia's policies towards Yemen, in particular the directed at the predominantly Shiite province, a the main causes of the conflict (ICG 2009). Allameh Seyed Badr-o-din Alhusi declared in a statement that his son was only defending Islam.

2.2. The Second War and the Third War

In March 2005, harsh accusations were exchanged between the Yemeni President, Ali Abdullah Salih, and Allamah Sayyid Badruddin al-Houthi and Sheikh Abdullah al-Razami. President Ali Abdullah Salih accused the Shiites of trying to overthrow the republican system to restore the Zaidi Imamate system, while Allamah Badruddin accused the President and the government of having failed to do anything to end the disputes. The Yemeni government also tried to portray the Houthis as a terrorist group responsible for the operations launched against government officials and foreign diplomats (ICG 2009).

The second stage of the war began with army's attack on the North and West of "Saada" and cities including "Almajz," "Sahar," and "Baghem". After two month, the army declared victory and the war appeared as if it had ended in May 2005. Experts considered the third stage of the war as something that did not bring any real resolution to the disputes, and rather a continuation of the second period of the war, which officially began when a tribal conflict between the two sides arose in late 2005 and early 2006.

The main characteristic of the third stage of the war was the rise of Sayyid Abdolmalek al-Houthi, Sayyid Husain al-Houthi's brother, to the Houthis' leadership. The upcoming 2006 presidential elections led to a temporary cessation of the army's attacks as well as a declaration of ceasefire (ICG 2009).

2.3. The Fourth War

In February and June of 2007, the government accused the Houthis of threatening the Jews in the Sa'dah province. Although the Houthis denied this accusation, it provided sufficient excuse to launch another war.

New period of war continued with more intensity than before. It became more official and the tribes were actively used. The fourth period of war ended with intermediation efforts by the Emir of Qatar, Sheikh Hamad bin Khalifa Al Thani and a delegation from the Ministry of Foreign Affairs of Qatar. The Doha agreement was signed on February 2, 2008, and the Qatar government promised to send necessary aid to rebuild the war-torn regions. (Ibid).

2.4. The Fifth War

Doha agreement did not last long and the both sides accused each other of violation of provisions. The fifth war began in March 2008 and expanded into some sectors of Sana'a, the capital of Yemen. At this time, "Haras-al-Jomhouri," commanded by Ahmad Ali Salih, Yemeni President's son, entered the battlefield. Some of the experts argued that the competition between General Ahmad Ali Salih and Ali Mohsen Al-Ahmar, Army Commander, gave new dimensions to the crisis (Nasir 2009). This phase of the war ended on January 17, 2008 with the army's declaration of unilateral ceasefire, which coincided with 30th year of Ali Abdullah Salih's presidency.

In addition, other reasons such as the government's fear of losing control over the war, as

well as the intermediation of the local activists, and criticism from human right organizations against the grave conditions of war victims, led to the temporary end of the war (Hamidi 2009).

2.5. The Sixth War

The end of the fifth phase of the war had no clear horizon. Most experts anticipated the war to resume. The sixth war began in August 11, 2008 with the kidnapping of several foreign tourists in Yemen and the Houthis being accused of collaborating in the incident despite their denial (Rashid 2009). This operation expanded and continued with more intensity. The government named it the "Burnt Land" operation (De Johnsen 2009).

One of the sixth war's particular features was the participation of Saudi Arabia Air Force. Another was the involvement of the U.S. in the second stage. Scholars believe that the Yemeni government made great efforts to include the Houthi group in the U.S. terrorist organizations list (Al-Salahi 2009).

Another feature of the sixth war was its extension to the Yemen and Saudi Arabia border regions. The war dragged on and after almost seven months, this phase of the war ended in January 2010, aided by local mediation and secret agreements. As the wars continue on and off, the authors of this paper concur that identifying the roots of the fundamental differences is an urgent task.

3. ROOTS OF THE SIX FOLD WARS

In their study of the wars in Yemen, the Middle East and Arab experts have pointed to one or more factors as the primary causes of the crisis. One of the studies belonging to this school is the book *Al-Houthiyyah fi al-Yaman: Atma' Maz-habiyyah fi Dhill al-Tahawwolat al-Dawliyyah* (The Houthis phenomenon in Yemen: Religious Ambitions in the Light of International Developments), published by a team of experts of Al-Jazeera Studies Center in Doha, Qatar, in 2008. In their explanation of the developments of the crisis, the authors considered sectarian factors as the main causes of the war.

The International Crisis Working Group dealt with the war in Yemen in its Report No. 86 on the Middle East. The report argued that the crisis was caused by a set of factors with several root causes. This report was notable for its field research method and its real-time, accurate description of the crisis. However, it does not specify the extent of the influence of each factor. Abdul-Fattah Muhammad al-Batul, in "Khuyut al-Zalam: Asr al-Imamah al-Zaidiyyah fi al-Yaman (Threads of Darkness: the Era of Zaidis' leadership in Yemen)," employed a reductionist approach to study the history of Yemeni Shiites, and describes 11 centuries of the history of Zaidi rule as the "thread of darkness," i.e. the path of deviation. In that regard, this research concurs with the government's perception of the Houthis (Al-Batool 2007).

In addition to the above studies, there is a huge volume of journalistic articles, interviews, television programs and conferences, where specialists and experts presented their viewpoints regarding the roots of the crisis. Many of these opinions have been collected and reviewed. After a thorough review of the previous research performed on this topic, one can separate these root factors into two categories: internal and external.

3.1. Internal Factors

Yemen's fragile economy is one of the major causes of the crisis. Yemen is a low-income country, intensely dependent on its shrinking oil resources. Oil counts for almost 25% of the GDP and 70% of the state's revenue. Its real average annual GDP growth rate since 2000 has remained at 3~4 percent. The declining oil prices since mid-2008 have led to the aggravation of economic pressure on the country's underdeveloped economy. To deal with the effects of declining oil resources, Yemen has tried to invigorate its non-oil sectors by implementing economic reforms plan which was drawn up in 2006. Based on this plan, the country managed to export liquefied natural gas for the first time in October 2009. Despite its ambitious plans, Yemen faces difficult long-term challenges such as the shortage in water resources and a high population growth rate (CIA 2009).

Besides the overall economic problems, the lack of government's attention to and investment in the Shiite provinces in the north, since the fall of Imamat Regime, has led to a degradation of the economic crisis in Shiite provinces (Shahmoradi 2009).

Another factor is tribal social structure in Yemen, where the identities of the people are defined within a clan framework. Yemenis pursue their personal and family rights in this context (Hudson *et al*. 1994). It should be noted that since the third phase of the war, tribes have actively participated in the war; each tribe, according to its values and interests' priority, has entered in war in favor of one side or another (Bahesin 2008).

The third problem which has continued to attract the attention of the analysts, is the religious differences and the lack of religious tolerance. Considering that the Shiites' protests had been against Saudi Arabia and the policies and excessive influence of Salafists, some scholars accept the factor of religious differences. To prove this issue, refer to Salafists' assault on the Shiites' sanctuaries, publication, and distribution of books against Zaidi clergies in the Shiite provinces, destruction of the sacred tombs and the Shiite mosques, and Shiites' reaction to these procedures (Al-Salahi 2009; Hamidi 2009).

These religious differences, though they do exist, are considered as less important factors by the Houthi leaders (Abullah 2009). This is because, before the crisis, Yemen was a very interesting example of peaceful coexistence between Zaidi Shiites and Shafi'i Sunni. Followers of both sects, unlike other countries and Islamic sects, prayed in the same mosques and behind the same Imam in Yemen. This was a unique example of unity. It also showed that there was little difference between Islamic sects.

Besides the above factors, some scholars see the Yemeni government, the ruling system, and its inherent weakness as the main cause of the wars (Phillips 2005). They identify that the underdeveloped state of the political system, the disregard for pluralism, concentration of power in the military, the competition between Ahmed Ali Salih and General Ali Mohsen Al-Ahmar the commander of the Army over the presidency, and Ali Abdullah Salih's intention to allow the presidency to be inherited, as the main causes of the conflicts (ICG 2009).

Some scholars also point to the Houthis as the main cause of conflicts. These analysts also believe that Zaidi Houthis have departed from the principles of Zaidia, and are biased towards the twelver Shiitesm which is officially represented by the Islamic Republic of Iran, southern Iraq and Hizbullah of Lebanon (Al-Batool 2007; Abu Ras 2009).

Beside the above factors, 'Isam 'Imad, the former speaker of the Assembly of the Shiites of Yemen, pointing the parties to the conflict, identifies the whole government of Yemen, the ruling regime, and its intrinsic weaknesses as the main cause of the wars. He also

believes that the underdeveloped political system, the absence of pluralism, the extraordinary power of the army in the country, the rivalry between the president's son Ahmad 'Ali Salih, and the army's commander General 'Ali Muhsin al-Ahmar over the presidency, and the desire of the current President to hand over the presidency to his son, as documented in 'Ali Abdullah Salih, are among the main causes of the conflict (ICG 2009).

3.2. External Factors

Since the 2001 9/11 incident, the Houthis have continued to object to the war against Afghanistan and Iraq by NATO, the U.S., and the British governments under the pretext of fighting terrorism, the alliance and cooperation of the Yemeni government with the U.S., and the U.S. foreign policy toward the Middle East and the region including the U.S. support of Israel (Abullah 2009; Hatita 2009).

In stressing the external factors affecting the crisis, some researchers view the conflict in Yemen as a proxy war. Citing the religious differences between the Wahhabis and the Shiites and the governments which represent them, namely Saudi Arabia and the Islamic Republic of Iran as evidence, they argue that this war is being fought in Yemen's territory on behalf of these two countries (Badrkhan 2009; Abu Zahr 2010).

Some scholars, emphasizing that the Houthis and the twelve Shiites in Islamic Republic of Iran share the same views on important doctrinal and international issues, believe that they are affiliated to the Islamic republic of Iran (Al-Harethi 2009). Other scholars go beyond the doctrinal issues, and claim that the Iranian militarily supports the Houthis (Al-Zayedi 2009; Al-Serjani 2009). However, this claim has repeatedly been rejected by the officials of Iran and Houthis leaders. The Houthis, in response to these claims, have countered that they have no affiliation to any group or country, and that these allegations are intended only to justify Saudi Arabia's military presence. They explain that they obtained their weapons as spoils of war obtained over several phases of the war. They also refer to the Yemeni tradition of carrying guns (Abullah 2009).

Since the fourth war started based on the Yemeni government's allegation that the Houthis threatened the Jews of the Sa'ada province, some researchers, in view of the fact that there has been no religious differences between the Shiites and the Shafi'i Sunnis, who constitute the religious majority of Yemen and, instead, the followers of these religions respected each other's ideologies mutually and peacefully coexisted for one thousand years of Zaidi Imams' rule, conclude that the policy of "divide-and-rule" is being pursued by Israel and that the crisis in Yemen and other parts of the Muslim world is an extension of the same policy (Mohammadifar 2006; Al-Museli 1998). The constant objection of the Houthis against Israeli policies toward Palestine and against the Yemeni foreign policy toward Israel, represented by its support of the peace process, and the inclusion of the statement "Down with the Jews" in their slogan, convinced us to also consider Israel as another external factor affecting the crisis in Yemen.

Qatar is another external factor which, since the fourth war, has officially tried to play an effective role in the crisis. Qatar has propped itself as a regional mediator. Qatar has tried to play an important role in the settlement of the Yemeni crisis as well (Al-Hamiri 2009). In a visit to Yemen in May 2007, the Qatari emir, Sheikh Hamad Bin Khalifah Aal Thani, declared his country's readiness to intermediate between the main parties to the conflict. This intermediation led to the conclusion of the Doha accord (Hamidi 2009). Some analysts believe that the failure of this intermediation and its ensuing accord to prevent the

resumption of war is due to the ongoing rivalry between Saudi Arabia and Qatar in the region (ICG 2009). The Houthis believe that the Yemeni government took advantage of Qatar's involvement as a means to obtain more financial and military support from Saudi Arabia (Abullah 2009).

It is worth mentioning that the war, in spite of all the numerous financial and physical damages, has led to some gains for the Houthis. The most important among them is the acceptation and recognition by the Yemeni government of the Houthis – upon the signing of the Doha agreement – as well as the Yemeni public's attention to the Shiites, and the loss of legitimacy of the Ali Abdullah Salih's Regime. The Houthis led to shape a widespread popular protest in 2001 that fundamentally threatened the existence of regime.

In addition to the above two cases, resistance and confrontation of the Houthis against the Yemeni army and the Saudi Arabia Air Force, and diffusion of images of bases near Saudi Arabian borders plundering their military equipment on the internet in sites including YouTube, have increased Houthis' defense and military prestige. They have become a warning force for Saudi Arabia, because Shiites are the minority in Yemen, and are discontented with government policies.

4. ANALYSIS OF FACTORS DERIVED ON THE BASIS OF FUZZY COGNITIVE MAPS (FCMS)

The cognitive maps (CMs), which were introduced for the first time by Robert Axelrod, are used to solve problems with no definite structure. CMs are a representation of the causal relations among several objects or problems which include the experts' opinions with respect to an abstract reality rather than a concrete one. CMs contain two main elements of concepts and causal relations which are represented under the rubrics of variables and the relations among the variables, respectively. Causal relations link the variables to each other and can be either positive or negative. The variables which lead to variation are called "cause" variables and the variables which are affected by the variations are called "effect" variables. In Figure 1, an example of cognitive map is demonstrated (Mohammadian *et al.* 2006).

Considering that CMs have a qualitative domain and taking the quantifying capability of the fuzzy logic into consideration, Kosko introduced fuzzy CMs with fuzzy weights (Kosko 1986). In these maps, the paths, in addition to having a positive or negative causal direction, took on numeral weights from -1 to 1 which indicated the extent of the variables' effect on
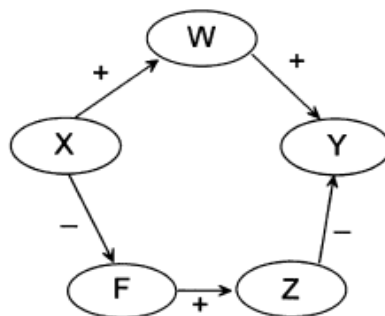

Figure 1. Cognitive map

each other. The fuzzy CMs eliminate the problem of indefiniteness in the actualization of general effect. These maps have been used for modeling political and social processes, identifying the managerial problems of organizations, information technology, and environmental problems (Mohammadian *et al.* 2006). In the present research, in order to take into account the vagueness of the factors affecting the Yemeni crisis as well as the complex interactions among them, fuzzy CMs have been utilized to find a model for the Yemeni crisis.

Data collection was performed in two stages. In the first stage, the researchers identified the fundamental factors which influenced the crisis by studying the available resources, such as books, papers, and newspapers which had been published concerning the crisis. Upon the study's completion, those factors were divided into two groups including the internal factors (such as economic problems, tribal structure, religious differences, the underdevelopment of political system or the absence of pluralism, the Yemeni Shiites and the Yemeni government) and the external factors (namely Israel, the U.S., Saudi Arabia, Iran and Qatar). After identifying these factors, the causal relationships among them, namely the direction of their effect as well as the magnitude of their effect on each other, had to be established.

Table 1. Matrix filled out by one of the specialists

	Israel	U.S.	Saudi Arabia	Iran	Lack of Political Pluralism	Tribal Structure	Yemeni Government	Religious Differences	Economic Problems	Crisis
Israel	0	- High	- High	- Low	None	None	- High	- High	None	Average
U.S.	- Average	0	- Very high	- Low	None	None	- Very high	- Low	None	- Very high
Saudi Arabia	None	None	0	- Low	- Low	- Very high	- Very high	- Very high	- High	- Very high
Iran	- Average	- Average	- Low	0	None	None	- Low	None	+ Average	+ High
Lack of Political Pluralism	None	None	None	None	0	- Low	- Very high	- High	- Average	- High
Tribal Structure	None	None	None	None	- Average	0	- Average	- Average	- Low	- Average
Yemeni Government	None	None	None	- Low	- Very high	- High	0	- Very high	- Very high	- Very high
Religious Differences	None	None	- Low	- Low	- Very high	- Very high	- High	0	- Average	- Very high
Economic Problems	None	None	None	None	- Average	- Average	- High	None	0	-Very high
Crisis	None	None	None	None	- High	- High	- Very high	- Very high	- High	0

Table 2. The criterion for scoring the fuzzy expressions

None	Low	Average	High	Very High
0	0.25	0.5	0.75	1

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Table 3. The matrix of fuzzy numbers of one of the specialists

	Israel	U.S.	Saudi Arabia	Iran	Lack of political pluralism	Tribal structure	Yemeni government	Religious differences	Economic problems	Crisis
Israel	0	-1	-0.75	-0.25	0	0	-0.75	-0.75	0	-0.5
U.S.	-0.5	0	-1	-0.25	0	0	-1	-0.25	0	-1
Saudi Arabia	0	0	0	-0.25	-0.25	-1	-1	-1	-0.75	-1
Iran	-0.5	-0.5	-0.25	0	0	0	-0.25	0	0.5	0.75
Lack of political pluralism	0	0	0	0	0	-0.25	-1	-0.75	-0.5	-0.75
Tribal structure	0	0	0	0	-0.5	0	-0.5	-0.5	-0.25	-0.5
Yemeni government	0	0	0	-0.25	-1	-0.75	0	-1	-1	-1
Religious differences	0	0	-0.25	-0.25	-1	-1	-0.75	0	-0.5	-1
Economic problems	0	0	0	0	-0.5	-0.5	-0.75	0	0	-1
Crisis	0	0	0	0	-0.75	-0.75	-1	-1	-0.75	0

Therefore, the identified factors were designed in the form of a matrix and presented to four specialists in the field of Yemeni issues. The specialists were requested to determine the directions of their effects – as either positive (meaning the mitigation of the crisis) or negative (meaning the escalation of the crisis) – and the magnitude of their effects using the statements "none, little, average, high, and very high." The specialists were also asked to delete the factors which they considered as redundant or to add the factors which had been overlooked. One of the matrices produced by the specialists is shown in table 1.

After the matrices were filled out by the specialist, the matrices were transformed to fuzzy numbers according to the criterion set forth in (Hossain and Brooks 2008). The criterion is shown in table 2. Table 3 shows the fuzzy matrix related to table 1.

After transforming the filled matrix by specialists to the matrix of fuzzy numbers, the matrices were combined together and the complete fuzzy matrix was reached. Then, they said matrix was entered in the FCM mapper (fcmmapper.com) so it could be analyzed. Table 4 shows the complete fuzzy matrix.

Table 4. The fuzzy matrix of the complete cognitive map

	Israel	U.S.	Saudi Arabia	Iran	Qatar	Economic problems	Social structure	Religious problems	Under-development of political system	Shiites of Yemen	Yemeni government	Crisis
Israel	0.00	-1.00	-0.75	-0.50	-0.25	0.00	0.00	-0.75	0.00	-0.75	-0.50	-0.75
U.S.	-0.50	0.00	-1.00	-0.75	-0.25	0.00	0.00	0.00	0.00	-1.00	-1.00	-1.00
Saudi Arabia	0.00	0.00	0.00	-0.50	-0.75	-0.25	-0.75	-1.00	-0.25	-1.00	-1.00	-1.00
Iran	-0.50	-0.50	-0.50	0.00	0.25	0.50	0.00	0.00	0.00	0.75	-0.25	0.50
Qatar	0.25	0.00	-1.00	0.50	0.00	0.75	0.00	0.25	0.25	1.00	0.50	1.00
Economic problems	0.00	0.00	0.00	0.00	0.00	0.00	-0.25	-0.50	-0.75	-1.00	-0.75	-1.00
Social structure	0.00	0.00	0.00	0.00	-1.00	0.00	0.00	-0.50	-0.75	-0.75	-0.75	-0.75
Religious problems	0.00	0.00	0.00	0.00	0.00	0.00	-0.25	0.00	-0.75	-1.00	-1.00	-1.00
Under-development of political system	0.00	0.00	0.00	-0.25	-0.25	-0.75	-0.25	-0.50	0.00	-0.75	-0.75	-1.00
Shiites of Yemen	0.00	0.00	0.00	0.00	0.00	-1.00	-0.25	-0.50	-0.25	0.00	-0.25	-0.25
Yemeni government	0.00	0.00	0.00	-0.25	-0.50	-0.75	-0.75	-0.75	-0.50	-1.00	0.00	-1.00
Crisis	0.00	0.00	0.00	0.00	0.00	-1.00	-0.75	-1.00	-0.25	-1.00	-0.75	0.00

5. ANALYSIS OF THE FUZZY MAPS

Cognitive maps are complex systems because they comprise of a multitude of variables and causal connections among them. The analysis of such complex cognitive maps is very difficult. However, the tools offered by the matrix algebra of the graph theory provide some ways for the analysis of their structure. By testing the structure of the maps, one can determine how the specialists see the system; for example, whether, in their opinion, it is the internal factors or the external ones that influence the Yemeni crisis, or which one of the internal factors has the greatest effect.

To analyze a cognitive map, the number of variables, denoted by "N", and the number of connections among them, denoted by "C", can be counted. Nevertheless, beside the number of connections and variables, the graph theory provides certain other indicators, too. The Density or Clustering Coefficient of a fuzzy cognitive map is the indicator of its connection which shows how interconnected or unconnected the map is (Özesmi and Özesmi 2004). In the present research, the density of the whole cognitive map is 0.6 which means that 60% of all possible paths are covered by the map. However, it shall be noted that density has a reverse relationship with the size of the network. Therefore, by the increase of the variables, the number of possible paths highly increases. Due to this dependence on the size of network, the density of network is not a useful tool for interpretation (De Nooy *et al.* 2005). But the measure of centrality is a very useful tool for comparing the variables in the map or the

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network. The measure of the role of a certain variable in a cognitive map can be explored through calculation of its centrality which shows how a variable is connected to other variables and also how much the cumulative strength of these connections is. In fuzzy cognitive maps, contrary to cognitive maps, since the weights of the paths are also taken into consideration when calculating the centrality, a variable can have a high centrality, even though it has little connection with other variables, because it may have many weights with connected variables.

Centrality is calculated by the addition of the "in-degree," i.e. the number of the pointed edges which point toward a node or a variable, with the "out-degree," i.e. the number of the vertexes or causal paths, which come out of a node or variable. Furthermore, if the out-degree of a variable is positive and its in-degree equals to zero, it is called "transmitter" which indicates that the variable is a source of influence. But of the in-degree of a variable is positive and its out-degree equals to zero, it is called "receiver," which indicates that the variable is influenced. The ordinary variables also have a positive out-degree and in-degree which indicates that the variable is either a source of influence or its receiver (Özesmi and Özesmi 2004). These indicators are reported in Table 5.

Table 5. The graph indicators of the whole fuzzy cognitive map

Density	Total Nr. Factors	Total Nr. Connections	Nr. Transmitter	Nr. Receiver	Nr. Ordinary
0.597222222	12	86	0	0	12

Table 6. The graph indicators of each variable

Concepts	Out-degree	In-degree	Centrality	Transmitter	Receiver	Ordinary
Israel	5.25	1.25	6.50	-	-	1
U.S.	5.50	1.50	7.00	-	-	1
Saudi Arabia	**6.50**	**3.25**	**9.75**	-	-	1
Iran	3.75	2.75	6.50	-	-	1
Qatar	5.50	3.25	8.75	-	-	1
Economic problems	4.25	5.00	9.25	-	-	1
Social structure	4.50	3.25	7.75	-	-	1
Religious problem	4.00	5.75	9.75	-	-	1
Lack of political pluralism	4.50	3.75	8.25	-	-	1
Shiites of Yemen	2.50	10.00	12.50	-	-	1
Yemeni government	5.50	7.50	13.00	-	-	1
Crisis	4.75	9.25	14.00	-	-	1

5.1. Table 6 shows that in Yemen, the crisis has the highest centrality (14)

As the fuzzy map suggests, the crisis so far led to hundreds of deaths on both sides and homelessness of thousands of families. The crisis has affected almost all the factors and over time has brought about new variables, elements, and actors into the conflict. War in Yemen, has brought about economic paralysis, social structural gap, and more appearance of religious and ethnic– tribal divisions. The crisis has also weakened the government. Turning the army against the people who have quickly been turned into "insurgents" has diminished the regime's legitimacy.

5.2. The government has the second highest centrality (13)

Yemeni crisis is primarily a domestic problem and the government is responsible to manage it. In addition, government with its mechanism and devices even with the regional and international actors' desire to meddle in its internal affairs, was able to manage it and prove its goodwill to its people who are doubtful about its policies.

The Shiites of Yemen have the highest in-degree (10), which indicates that they receive the highest influence from other factors.

On the other hand, Saudi Arabia has the highest out-degree (6.5) which shows that it has the highest effect on the other factors. The following points are noteworthy with respect to Saudi Arabia's meddling in the Yemeni conflict:

1. Saudi Arabia has three Yemeni provinces, namely 'Asir, Najran, and Jizan, under its occupation. According to the Ta'if accord of 1934 between the high ranking officials of the two countries, Riyadh was obliged to return the three provinces to Yemen by 1954. However, it has continued to occupy these provinces by renewing the accord in 1954, 1974, and 2004. It has been suggested that by consecutively extending the Ta'if accord, Saudi Arabia has practically annexed these three provinces.

2. Saudi Arabia and Yemen are the only two countries in the Middle East that have not demarcated their borders, due to the multiplicity of border and territorial disputes. In fact, Saudi Arabia has forever coveted Yemen's territory since its independence. This problem has led to the outbreak of a conflict every two years.

3. Saudi Arabia occupies several Yemeni islands in the Red Sea and the Arabian Sea. The Saudi military forces captured the Yemeni island of Deohurap 10 years ago and declared that unless Yemen evacuated 'Ashiq island, which belongs to Yemen, Saudi Arabia would continue to hold on to Deohurap Island. In the same year, in 1998, Saudi Arabia captured another Yemeni island - al-Duwaimah in the Red Sea - by force. The Saudis now occupy a total of 10 Yemeni islands (Zare'e 2009; Sultan 1996).

Finally, the lowest out-degree belongs to the Shiites (2.5), which indicates that this variable has the least influence on other variables and factors.

Other factors that have been considered influential in other researches appear to have had less impact in continuity or resolution of crisis, according to the fuzzy cognitive map. For example, Qatar's attempts of mediation, because of the abuse of this mediation by interested parties in crisis, have been revoked. Analysis shows that this factor may be magnified. At the same time, another factor, despite its high impact, may not be seen. Figure 2 shows the fuzzy cognitive map of the Yemeni crisis.
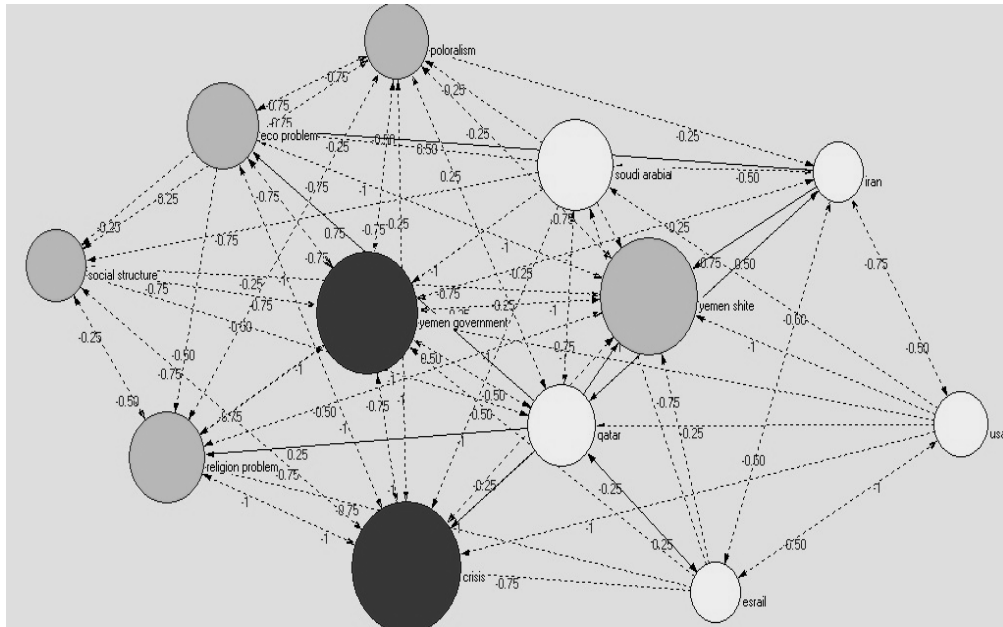
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Figure 2. The complete fuzzy cognitive map

In the above figure, the size of each variable has been determined based on the magnitude of its centrality. For example, the crisis has the highest centrality. The grey colored variables signify internal factors and the white variables represent external factors. Since the two variables "crisis" and the "Yemeni government" which are among the internal factors have the highest centrality, they are illustrated with a darker color. Also the negative causal paths and the positive paths are shown by dots and lines, respectively. The fuzzy weights of the paths are noted next to them.

6. CONCLUSION

The goal of this research has been to explore the roots of the six stages of the war of Yemeni government and the Shiites of that country. Through a literature review, the authors noted that no research has comprehensively studied the roots of these wars and that all of the analyses have focused only on a few factors of the war. Moreover, given the complexity of the issue which began six years ago and that the crisis continues to escalate every year, a fuzzy cognitive map has been used for the analysis of the crisis. As the fuzzy cognitive map of the Yemeni crisis shows, the phenomena of the crisis and the Yemeni government have the highest degree of centrality. So far, the crisis has led to the dislocation of hundreds of thousands of households and the death of many people from those who are non-parties to the conflict. The crisis has inevitably dragged other regional and international players into the fighting and disrupted life in northern Yemen. In addition, a large number of the Yemeni population have become refugees who, could have been a source of national economic and political strength. The second important point is that the Yemeni government has the greatest centrality in the fuzzy analysis. As the Shiites argue, if the Yemeni government had

prevented the anti-sectarian activities of the Salafis in the Shiites' provinces or if it did not exacerbate the sectarian differences by siding with one of the parties, and instead provided the Yemeni Shiites with the opportunity to peacefully express and pursue their demands, and accomplished this independently, the flames of war would have most probably receded.

According to the fuzzy analysis, the actions of the Yemeni government, and the weaknesses and faults in its dealing with the crisis have increased the intensity of the crisis inasmuch as it has made the crisis into a factor that directly affects the other factors. The crisis has become so central that it determines the policies of the government and external forces. Hence, the Yemeni government must think about managing the crisis, instead of being affected by it and intensifying the situation's complexity by adding other external actors. In this context, the actions of the government can be considered as the main cause of the crisis.

According to the resulting cognitive map, Saudi Arabia has the highest effect on the other factors. The present paper considers Saudi Arabia's meddling in the crisis, and generally, the influence that the said government exercises on the Yemeni government and society, as another reason for the prolongation of the crisis.

Saudi Arabia's intervention has also counteracted the Qatari mediation. If Saudi Arabia had helped the Yemeni government to overcome its numerous economic problems instead of providing it with military support, it could have secured its southern borders. It also could have taken a positive step toward the settlement of the crisis in Yemen.

The Yemeni government, in the first place, and international organizations, in the second place, can gradually neutralize the effect of the second cause of the crisis, namely the direct intervention of Saudi government, and observe its impact on the development of the situation.

In terms of methodology, this study showed a way to identify factors influencing a phenomenon and to understand the role of factors, in order to provide better context and awareness in making decisions during crises. By eliminating the factor that has more effect in the fuzzy cognitive map, and measuring its effect on the new map, this method can help decision-makers adopt policies that can help mitigate the crisis in the real world.

Although this paper was been written before the recent developments of Yemen with respect to the Arab Spring, the factors affecting the crisis of the wars between the government and the Shiites of Yemen have continued to be at play in the present crisis and continue to exacerbate the situation.

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