A Rough Set Theory Based Approach to Work-Family Dynamics and its impact on Organizational Citizenship Behavior and Organizational Commitment

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Abstract

This study utilizes a rough set theory (RST)-based approach to investigate the influence of work-family conflict (WFC) and work-family enrichment (WFE) on organizational citizenship behavior (OCB) and organizational commitment (OC). WFC and WFE are pivotal factors shaping employee attitudes and behaviors, as individuals strive to balance professional responsibilities with personal obligations. The interaction between these factors can significantly affect employees' commitment to their organization and their engagement in discretionary, prosocial behaviors that contribute to workplace effectiveness.

Given the complexity and inherent uncertainty in these relationships, rough set theory (RST) is employed as a data-driven method to analyze ambiguous and overlapping patterns within the dataset. RST enables the identification of key decision rules that explain how WFC and WFE contribute to variations in OCB and OC. The findings enhance theoretical perspectives on work-family dynamics while also providing actionable insights for organizations aiming to develop strategic policies and human resource interventions. By addressing both the challenges and benefits associated with work-family interactions, this research offers valuable guidance for fostering a supportive organizational culture that reduces conflict, promotes enrichment, and enhances overall employee engagement and commitment.

Keywords: Work-family conflict, Work-family enrichment, Organizational citizenship behavior, Organizational commitment, Rough set theory, Decision rules.

Introduction

The shifting patterns of employment, particularly the rise of dual-earner households, have significantly reshaped both work and family roles. Balancing professional and personal responsibilities has become increasingly challenging, leading to time constraints, heightened stress, and disruptions in work-life harmony. Effective time management has emerged as a critical issue, as individuals struggle to fulfill their commitments in both domains. The inability to manage these demands often results in work-family conflict (WFC), which negatively impacts overall well-being, job satisfaction, and family relationships. Conversely, a supportive work environment and job satisfaction can enhance personal well-being by fostering work-family enrichment (WFE).

Work-family conflict (WFC) is a form of inter-role conflict that arises when work and family responsibilities are incompatible, making it difficult for individuals to meet the demands of both. WFC can take different forms, including time-based conflict (competing demands on time), strain-based conflict (stress from one role affecting the other), and behavior-based conflict (incompatible role expectations). It is associated with adverse outcomes such as increased stress, burnout, reduced productivity, absenteeism, and strained family relationships.

On the other hand, work-family enrichment (WFE) refers to the positive spillover between work and family roles, where experiences, resources, and skills gained in one domain enhance performance and satisfaction in the other. Factors such as job autonomy, social support, and psychological well-being contribute to WFE, leading to greater job satisfaction, improved mental health, and stronger family relationships.

The interplay between work and family roles significantly affects employee behavior and organizational outcomes. Work-family conflict (WFC) arises when the demands of work and family are incompatible, leading to stress and reduced job satisfaction. Conversely, work-family enrichment (WFE) occurs when experiences in one domain enhance the quality of life in the other. These constructs have profound implications for organizational citizenship behavior (OCB) and organizational commitment (OC), which are essential for employee engagement and retention.

This paper utilizes the rough set theory (RST)-based approach to extract knowledge about the consequences of WFC and WFE on OCB and OC. Rough Set Theory (RST) is employed as a data-driven machine learning method to analyze complex relations and patterns within an information dataset. RST enables the identification of key decision rules that explain how WFC and WFE contribute to variations in OCB and OC. The findings enhance theoretical perspectives on work-family dynamics that can predict OCB and OC while also providing actionable insights for organizations aiming to develop strategic policies and human resource interventions. Results show that RST could be an effective alternative to the classical approaches for this kind of problems.

Literature Review

Consequences of Work-Family Conflict

Work-family conflict (WFC) arises when work and family demands are incompatible, leading to stress, decreased job satisfaction, and impaired well-being. Greenhaus and Beutell (1985) identified time-based, strain-based, and behavior-based conflicts, linking WFC to lower job and life satisfaction, increased stress, and reduced family well-being. The conservation of resources theory (Hobfoll, 1989) conceptualizes WFC as a process of resource depletion, often resulting in burnout, emotional exhaustion, and prolonged health issues.

Frone, Russell, and Cooper (1992) distinguished between work interfering with family (WIF) and family interfering with work (FIW), demonstrating that WFC contributes to physical (e.g., headaches, fatigue) and psychological distress (e.g., anxiety, depression). Allen, Herst, Bruck, and Sutton (2000) further emphasized WFC as a key predictor of burnout across diverse industries. WFC also negatively impacts workplace outcomes, including productivity, turnover, and employee morale. Kossek and Ozeki (1998) found that organizations with supportive work-family policies experience lower turnover rates. Similarly, Duxbury and Higgins (2001) highlighted the association between WFC, absenteeism, and turnover intentions, suggesting that employees struggling with work-life balance are more likely to leave their jobs. Demerouti, Mostert, and Bakker (2010) further explored the spillover effects of WFC on social relationships and community involvement, demonstrating its far-reaching consequences beyond the workplace.Recent research has extended the understanding of WFC in the context of technological advancements and remote work. Turkle (2011) emphasized how digital connectivity exacerbates WFC by blurring boundaries between work and personal life. Obrenovic et al. (2020) examined the psychological impact of WFC, revealing its negative effects on psychological safety and overall well-being, which in turn diminish job performance. Ribeiro et al. (2023) found that WFC lowers employee engagement and increases turnover intentions, highlighting its critical implications for workforce stability and retention.

Consequences of Work-Family Enrichment

In contrast to WFC, work-family enrichment (WFE) describes the positive spillover of resources, experiences, and skills between work and family roles, leading to improved well-being and organizational outcomes. Greenhaus and Powell (2006) identified WFE as a mechanism through which experiences in one domain enhance the quality of another, facilitated by skill development, social support, and psychological capital.

Research highlights WFE's positive impact on job satisfaction, organizational commitment, and employee engagement. Carlson et al. (2006) demonstrated that WFE contributes to overall well-being and job satisfaction, while Haar and Bardoel (2008) provided empirical support for the mutual enrichment between work and family roles. Studies by Akram et al. (2014) and Tang, Siu, and Cheung (2014) reinforced WFE's role in fostering higher work engagement and commitment, reducing turnover intentions, and promoting workplace productivity.

WFE has also been linked to innovation and career progression. Mishra et al. (2019) found that WFE enhances psychological capital, which positively influences innovative work behavior. Supervisor support was identified as a key factor in facilitating WFE and encouraging employees to leverage work-family balance for professional growth. Additionally, flexible work arrangements have been shown to enhance WFE, particularly for female employees (Chen et al., 2018). Beyond workplace benefits, WFE significantly contributes to family well-being and child development. Vieira et al. (2016) and Dinh et al. (2017) demonstrated that WFE fosters positive parenting behaviors and improves family relationships. Orellana et al. (2022) further explored its effects on dual-earner couples, revealing that WFE reduces psychological distress and enhances family satisfaction, particularly among fathers.

While WFE leads to numerous positive outcomes, its interplay with WFC remains an area of ongoing research. Praktika (2020) highlighted the dual nature of work-family dynamics, emphasizing the importance of interventions such as training programs to promote enrichment while mitigating conflict.

Previous Studies on Organizational Citizenship Behavior and Work Family Relationship:

Organizational Citizenship Behavior (OCB) refers to voluntary actions by individuals that support organizational functioning, even though these actions may not be directly related to specific tasks or jobs (Organ, 1988). Barnett and Hyde (2001) posited that involvement in multiple roles expands an individual's energy and resource base, which can foster investment in OCBs. Engaging in both work and family roles can increase intrinsic motivation, prompting individuals to exceed normal role expectations at work. Work-family enrichment (WFE) has been found to enhance job satisfaction (Greenhaus and Powell, 2006). Satisfied individuals are more likely to engage in OCBs compared to those who are not satisfied (Williams and Anderson, 1991). Therefore, the potential for WFE and family-work enrichment (FWE) to increase engagement in OCBs should not be dismissed. Given the limited research on the relationship between WFE and OCB (Balmforth and Gardner, 2006), this area warrants further examination.

Baral and Bhargava (2010) and Carlson, Kacmar, Grzywacz, Tepper and Whitten (2013) found that work-family enrichment and work-family balance, respectively, enhance employees' willingness to engage in OCB. According to the broaden-and-build theory, work-family enrichment can be seen as a positive emotion that expands individuals' thought-action repertoires. OCB fits within this expanded repertoire, as it strengthens relationships among coworkers and fosters a stronger connection between the employee and the organization (Mossholder, Settoon, and Henagan, 2005). Research by Rasouli, Shahaei and Safaei (2012) found that OCB towards the organization has a significant negative impact on employees' turnover intentions. Iraji Naghandar and Hamidi (2013) conducted a study on the relationship between perceived organizational support and OCB among employees of the Sport and Youth Organization in Mazandaran province. Their results indicated that perceived organizational support can predict all components of OCB. Employees who perceive greater support exhibit better citizenship behavior (Wang, 2014). Qasemi and Behzadi (2017) identified a significant and positive relationship between work-family enrichment and OCB. This finding further underscores the importance of examining the interplay between work-family dynamics and organizational citizenship behaviors.

Previous Research Studies on Organizational Commitment and Work Family Relationship:

Previous research has indicated that individuals who have difficulty balancing work and family responsibilities often demonstrate lower levels of affective organizational commitment (Karatepe and Sokmen, 2006). Akintayo (2010) examined the relationship between work-family role conflict and organizational commitment among industrial workers in Nigeria, finding a significant negative correlation between work-family conflict and organizational commitment.

Conversely, research has demonstrated that work-family enrichment can enhance affective organizational commitment. Aryee, Srinivas, and Tan (2005) identified a positive relationship between work-family enrichment (WFE) and affective commitment. Similarly, Balmforth and Gardner (2006) conducted a study in a New Zealand organization and found that positive work family interactions were strongly and positively linked to affective organizational commitment. Additionally, a study involving employees from an insurance company confirmed that work family enrichment was a positive predictor of affective organizational commitment (Julie, Amy, and Jaclyn, 2006). This finding was further supported by Karatepe and Magaji (2008) in their research on frontline employees at two luxury hotels in Nigeria, which showed that work-family enrichment contributed to an increase in affective organizational commitment. Wayne, Randel, and Stevens (2006) also found that work-family enrichment positively influenced affective organizational commitment, whereas family-work enrichment was linked to reduced turnover intentions. Additionally, Bhargava and Baral (2009) found positive associations between both work-to-family enrichment (WFE) and family-to-work enrichment (FWE) and affective commitment. Wayne, Casper, Matthews, and Allen (2013) investigated the impact of family-supportive organizational perceptions and found that these perceptions enhance employees' work-to-family enrichment, which in turn fosters greater affective commitment among employees. Additionally, they discovered that such perceptions reduce work-to-family conflict, resulting in a partner's more positive outlook on the employee's work schedule and a stronger commitment to the employee's organization. Individuals experiencing work-to-family enrichment (WFE) or family-to-work enrichment (FWE) often develop a sense of satisfaction that originates from the work domain, leading to higher levels of commitment to their tasks or organization. Some studies have consistently found a positive relationship between both directions of work-family enrichment and affective commitment (Aryee, Srinivas, and Tan, 2005; Balmforth and Gardner, 2006; Wayne, Randel, and Stevens, 2006). However, other research, such as Hill (2005), did not find the same correlation.

Conceptual Framework and Measurement

Work-Family Conflict (WFC)

Work-family conflict occurs when the demands of work and family roles interfere with one another, limiting an individual's ability to meet obligations in both domains (Greenhaus & Beutell, 1985). This conflict often leads to stress, reduced job satisfaction, and lower overall well-being. The Work-Family Conflict (WFC) Scale by Carlson, Kacmar, and Williams (2000) was used to assess WFC across three dimensions: Time-based conflict – When time demands from one role hinder participation in another. Strain-based conflict – When stress from one role negatively impacts performance in the other. Behavior-based conflict – When behaviors required in one role are incompatible with the other.

Work-Family Enrichment (WFE)

In contrast to WFC, work-family enrichment reflects the positive interaction between work and family roles, where engagement in one domain enhances effectiveness and well-being in the other (Greenhaus & Powell, 2006). The Work-Family Enrichment (WFE) Scale by Carlson et al. (2006) measures WFE through three dimensions: Development – The transfer of skills and knowledge from one role to another. Affect – The positive emotional impact of participation in one role on the other. Capital – The strengthening of personal resources that enhance performance across roles.

Organizational Citizenship Behavior (OCB)

Organizational Citizenship Behavior (OCB) refers to voluntary, non-mandatory actions that contribute to an organization's overall effectiveness (Organ, 1988). These behaviors include assisting colleagues, mentoring newcomers, taking on extra responsibilities, and promoting organizational values. The OCB Scale by Lee and Allen (2002) evaluates two key dimensions: OCB-Individual (OCBI) – Voluntary actions that benefit coworkers. OCB-Organizational (OCBO) – Behaviors that contribute to the organization's overall success.

Organizational Commitment (OC)

Organizational commitment reflects an employee's psychological attachment to their organization. Meyer, Allen, and Smith (1993) identified three types of commitment: affective, continuance, and normative. This study focuses on affective commitment, which represents an employee's emotional attachment and loyalty to the organization, often leading to higher job satisfaction and lower turnover intentions. Organizational commitment was measured using the scale developed by Meyer, Allen, and Smith (1993).

Methodology

Data Collection and Sampling

This study utilized both primary and secondary data. Primary data were collected through structured questionnaires, ensuring respondent confidentiality. The survey targeted employees from various Indian service organizations, with a total of 603 participants.

Scaling Techniques:

This study utilized validated Likert-type 5-point scales to measure key constructs, with response options ranging from "Strongly Disagree" to "Strongly Agree," scored from 1 to 5. A score of 3 represents the midpoint, indicating neutrality or uncertainty.

The following validated scales were used for assessment:

Work-Family Conflict (WFC): Measured using the WFC Scale by Carlson, Kacmar, and Williams (2000).

Work-Family Enrichment (WFE): Assessed via the WFE Scale by Carlson, Kacmar, Wayne, and Grzywacz (2006).

Organizational Citizenship Behavior (OCB): Evaluated using Lee and Allen's (2002) Scale.

Organizational Commitment: Measured with the Scale developed by Meyer, Allen, and Smith (1993).

Rough Set Theory Framework

Rough set theory (RST) is and effective machine learning tool that deals with the analysis of information in the form of data tables (Pawlak, 1991 ; Dey , Chatterjee, Chakravorti and Munsh,2008). It finds rules hidden in the information on the basis of causes and effects. RST is particularly effective where the information table may have superfluous, inconsistent or missing data. In the Likert scale based response analysis, chances of such superfluous, inconsistent or missing information are quite common.

Information System

According to RST, the data obtained from Likert scale based responses may be represented as a table, where each row represents a response received from a respondent. Each column represents the score for a particular parameter that is measured. In RST, these columns are called an attribute (a variable or parameter etc.) that can be measured or observed for each object (respondent). Such a table is called an information system. Mathematically, it can be represented as (Pawlak, 1991 ; Nguyen, 1997)

$T = \langle R, S, V, z \rangle$ (1)

Here, R is the set of respondents or objects and S is the set of variables, features or attributes. $V = \bigcup_{s \in S} V_s$ where Vs is the domain of the values of s and *z*denotes underlying relational function among the varibles as, $z : R \times S \rightarrow V$

Table 1. Example of a typical Information Table of Responses received from the respondents in a 5 point Likert scale format

Objects (Respondents)	Condition Attributes			Decision Attribute
	WFC_T	WFC_S	WFC_B	OC
R1	3	5	3	3
R2	4	4	5	3
R3	5	5	5	1
R4	4	3	4	4
R5	5	5	2	1
R6	2	3	2	4
R7	3	4	5	3
R8	5	5	5	5
R9	3	3	2	5
R10	4	4	5	1

Indiscernibility Relation

According to RST, for different attributes, two objects become *indiscernible*, i.e., undistinguishable, if they carry same information or in other words, they have the same values for the same attribute. If $X \subseteq S$ and $x_i, x_j \in R$, then the objects or respondents x_i and x_j will become *indiscernible* for the set *X*, if

$$z(x_i, s) = z(x_j, s), \forall s \in X \quad (2)$$

I_X is called an elementary set, for $X \subseteq S$, for an *X*-indiscernibility relation on *R* is satisfied as,

$$I_X = \{(x_i, x_j) \in R^2 \mid \forall s \in X \ z(x_i, s) = z(x_j, s)\} \quad (3)$$

As shown in Table 1, let, ***X***={***WFC_T***}. So, objects R1, R7 and R9 are indiscernible with respect to the attribute "WFC1", i.e., the first dimension of Work family conflict (WFC), because all of these three objects are having same value, "*3*", for attribute set ***X***. Similarly, objects R2, R4 and R10 are also indiscernible with ***X***. In this case, all of these objects are having value "*4*". In a similar way, the relation $\boldsymbol{I_X}$ defines four partitions of the universe, ***R*** (i.e. set of all cases),

$\boldsymbol{I_X}$ = { {R1, R7, R9} , {R2, R4, R10} , {R3, R5, R8}, {R7} }.

Similarly, for ***X***= {***WFC_T***, ***WFC_S***},

$\boldsymbol{I_X}$ = { { R1 },{ R2, R10 }, { R3, R5, R8 } , { R4 }, { R6 }, { R7 } , { R9 } }.

Rough Set based Approximation

In case of such an Information Table, usually it is observed that an attribute or feature such as "Decision" or "Effect" cannot be determined in a crisp manner. In the present example of Table 1, the set of objects {R3, R8} (marked in yellow colour) has same condition attribute values, i.e., for ***X={WFC_T, WFC_S, WFC_B}*** , {V_X}= {5, 5, 5}, but different decision attributes, i.e., R3 has a Decision value=1 and that for R8 is =5 as shown in Table 1. Hence, objects R3 and R8 cannot be identified in a crisp or precise manner, as they are creating ambiguity with their same values for the *condition attribute* but different values for the *decision attribute*. In such cases the data is handled well by *Rough Sets*. As per RST, it is possible to address the cases those have a positive decision (i.e., for example *definitely higher than 3*) with certainty, or those do not have a positive decision (i.e. *definitely not higher than 3)* with certainty. The objects like R3 and R8 belong to a *boundary region* which means that they do not belong to these *certain* sets. If the *boundary* set is not empty, i.e., the cardinality is non-zero for an information table, it is called a *rough set*. To illustrate these concepts, the previous Information Table (Table 1) has been modified and shown as Table 2. The decision attribute values of Table 1 which are *greater than 3* are represented as 1 and the values *not greater than 3* are represented as 0.

Table 2. Modified form of Table 1 after discretization of Decision Attribute

Objects (Respondents)	Condition Attributes			Decision Attribute
	WFC_T	WFC_S	WFC_B	OC
R1	3	5	3	0
R2	4	4	5	0
R3	5	5	5	0
R4	4	3	4	1
R5	5	5	2	0
R6	2	3	2	1
R7	3	4	5	0
R8	5	5	5	1
R9	3	3	2	1
R10	4	4	5	0

Let us assume that our information set as obtained from the responses contain a *rough set* indicated by *W*. Now, as per RST, *X-lower approximation* of *W* ($\underline{X}W$) can be defined by the following equation (4),

$$\underline{X}W = \{x \in W \mid I_X(x) \subseteq W\} \quad (4)$$

Similarly, *X-upper approximation* of *W* ($\overline{X}W$) is given in equation (5) as,

$$\overline{X}W = \{x \in W \mid I_X(x) \cap W \neq \phi\} \quad (5)$$

$\underline{X}W$ Indicates the set of objects that can be classified as the members of *W* with certainty. In a similar way, $\overline{X}W$ indicates the set of objects that can only be classified as the *possible* members of *W*. $B_X(W) = \overline{X}W - \underline{X}W$, is the set which is called the *X-boundary region* of *W*, which is made of those objects that cannot be classified as the members of *W* with certainty. $R - \overline{X}W$, is the *X-outside region* of *W* which contains those objects which are certainly not the members of *W*.

For the example considered here, the three condition attributes ***X*** = {***WFC_T, WFC_S, WFC_B***} and *W* is the set of objects or cases with Decision Attribute value = 1. It is evident from the Table 2 that, $\underline{X}W$, i.e., set of objects which can certainly be classified as the members of the set of *W* (i.e. Decision Attribute value = 1) is { {R4}, {R6}, {R9} }. Similarly, $\overline{X}W$, i.e. set of objects which can be only classified as possible members of *W* is { {R4}, {R6}, {R9}, {R3, R8} }. $B_X(W) = \overline{X}W - \underline{X}W$ = { {R3, R8} }. The *X-outside region* of *W*, i.e. $R - \overline{X}W$ = { {R1}, { R2, R10 } , {R5}, {R7}}.

Computation of *Reduct* and *Core*

In the previous section, it is observed that for reducing an information table we have to remove the superfluous information, i.e., the information which cannot crisply distinguish the objects with the values of the attributes. It is evident that, only one objects of any indiscernible equivalence set is sufficient to carry the information of the entire set. Hence, in the information table, one can keep only those attributes which can represent the whole information contained in the table. Some attributes are, therefore, superfluous or redundant as removal of those attributes doesn't pose a problem in extracting the information present in the information table. Thus by applying RST*, optimal* sets of attributes by reducing the dispensable features are called *Reduct* or $Reduct(X)$,where, $X \subseteq S$.

Form the *Reduct* set, Core set can be obtained as,

$Core(X) = \bigcap Reduct(X)$. *Core* and *Reducts* from the reduced information table generate the decision rules in "IF…THEN" formats. For a subset of attributes $X \subseteq S$, an attribute $s \in X$ may be removed from the table, i.e., the attribute is considered as a *dispensable* attribute if and only if, $I_X = I_{(X-\{s\})}$. If this condition is not satisfied, then s cannot be removed, i.e., it is *indispensable* in X.

$$Pos_X(Y) = \bigcup_{W \in I_Y} \underline{X}W \qquad (6)$$

$Pos_X(Y)$ actually represents the set of objects which can give consistent decision rule using Y-elementary sets using the information contained in I_X. If $s \in X$ and

$$Pos_X(Y) = Pos_{(X-\{s\})}(Y) \qquad (7)$$

then, s is removable or dispensable in X.
On the other hand, if equation (7) is not satisfied for s then it cannot be removed from the table, i.e., it is indispensable in X.

Rule Extraction and Decision-Making Process

Once the reduced information table is obtained on the basis of the dispensable and indispensable attributes by applying the RST, decision rules may be framed to represent the underlying relation among the input and output variables. Here, objects R2 and R10 (marked in light blue colour in Table 2) are the members of the same elementary set considering the set of condition attributes={***WFC_T, WFC_S, WFC_B***}and their decision attribute values are also the same (i.e. the value of OC is = 0). Thus, objects R2 and R10 can be precisely classified. It can be said that, attribute values, (WFC_T=4 ∧ WFC_S=4 ∧ WFC_B=5) are the characteristic for consistent decision class value =0 (i.e. OC value is *not greater than 3*), where, '∧' is logical "AND" operator. Here all the condition attributes are used, hence, these condition attributes are *indispensable*. However, there could be such information table where all of the condition attributes are not required for decision making. Those attributes are called *dispensable*. The reduced sets of attributed will then form the *reduct*. Set intersections of these *reduct* sets for each decision class (i.e. OC =1 or 0) indicates the *Core* for the corresponding decision rule. Here *Core* and *Reduct* values are same, because the condition attribute values for case R2 and R10 are same.

Thus, the rules obtained from the application of RST can be realized in the form of "IF *condition is this* THEN *decision is that*". For example, in the example given above, *Reduct* and *Core* can give us the decision rule:

IF *the value of attribute "WFC_T"= 4*
AND

the value of attribute "WFC_S"= 4
AND

the value of attribute "WFC_B"= 5
THEN

the value of decision attribute "OC" =0 (i.e. not greater than 3)

For a large information table, selection of optimal set of rules is a difficult task. Several algorithms are in use (Pawlak, 1991; Dey , Chatterjee, Chakravorti and Munsh,2008). In the present work Maximal Discernible (MD) heuristic is followed which is discussed in details in the study of (where condition attributes are also discretized, i.e., divided into range of values similar to the thing that is done for the decision attribute OC in Table 2.

Results and Discussions

Performance results of the proposed method

As mentioned in the previous section, RST is used to find the rule base for finding the effect of the WFC and WFE on OC and OCB. The information tables given as Table 3 and

Table 4 are used as the input to the RST based rule generation. 403 randomly chosen responses are considered from the total 603 respondents for this purpose. The remaining 200 responses are used to test the validity of the proposed method.

Table 3. A Part of the Information table for finding effects of WFC & FWC on OC and OCB

Object	Condition Attributes						Decision Attribute1 (OC)	Decision Attribute2 (OCB_I)	Decision Attribute3 (OCB_O)
	WFC_T	WFC_S	WFC_B	FWC_T	FWC_S	FWC_B			
1	4.00	4.50	3.00	5.00	3.00	4.00	3.00	1.75	1.75
2	4.00	3.50	3.50	2.00	4.00	2.50	3.33	1.00	2.00
3	3.50	4.50	3.50	5.00	4.00	2.00	1.67	2.00	1.75
4	5.00	4.00	4.50	5.00	2.00	4.00	2.83	1.00	3.25
5	4.50	4.50	3.50	5.00	4.00	2.50	1.50	1.00	2.00
6	3.50	4.00	4.00	2.50	4.00	4.00	2.50	1.00	2.00
· · ·	· · ·	· · ·	· · ·	· · ·	· · ·	· · ·	· · ·	· · ·	· · ·
398	1.00	3.00	2.00	1.00	1.00	2.00	3.83	3.75	3.00
399	2.00	2.00	2.00	2.00	1.00	1.00	4.83	4.00	3.50
400	2.50	3.50	3.00	1.00	1.50	2.00	4.00	4.00	4.00
401	1.50	1.00	3.00	1.00	1.00	1.00	2.67	4.50	4.00
402	2.00	4.00	1.00	1.00	1.00	2.00	4.67	4.00	3.00
403	2.00	2.50	3.50	1.50	1.00	1.00	3.83	4.25	2.50

Table 4. A Part of the Information table for finding effects of WFE & FWE on OC and OCB

Object	Condition Attributes						Decision Attribute1 (OC)	Decision Attribute2 (OCB_I)	Decision Attribute3 (OCB_O)
	WFE1	WFE2	WFE3	FWE1	FWE2	FWE3			
1	1.00	2.00	1.67	2.00	1.00	2.33	3.00	1.75	1.75
2	1.00	1.67	1.33	2.33	1.33	2.00	3.33	1.00	2.00
3	1.00	1.33	1.00	2.33	3.00	3.00	1.67	2.00	1.75
4	1.67	1.33	2.00	3.00	2.33	1.33	2.83	1.00	3.25
5	1.00	2.00	2.00	1.33	3.33	1.67	1.50	1.00	2.00
6	1.67	1.00	1.33	1.67	1.67	3.33	2.50	1.00	2.00
· · ·	· · ·	· · ·	· · ·	· · ·	· · ·	· · ·	· · ·	· · ·	· · ·
398	4.00	3.33	4.00	2.00	3.67	2.33	3.83	3.75	3.00
399	2.33	4.33	5.00	5.00	4.00	5.00	4.83	4.00	3.50
400	4.67	4.33	2.33	5.00	4.00	5.00	4.00	4.00	4.00
401	4.67	5.00	5.00	5.00	2.67	4.67	2.67	4.50	4.00
402	4.00	5.00	5.00	4.67	2.00	5.00	4.67	4.00	3.00
403	5.00	5.00	5.00	4.67	5.00	3.67	3.83	4.25	2.50

The rule generation process is described in the following subsections.

The data table is discretized

To apply RST on an information table, condition attribute values are divided into some ranges. To find these ranges, several machine learning algorithms may be used. In this work, Maximal Discernible (MD) heuristic is used to obtain the set of values for the discretization, which is discussed in details in (Nguyen, 1997; Dey, Chatterjee, Chakravorti and Munsh,2008) as mentioned in the previous section. In this work, the set of these discretization or range values for WFC_T is {1.5, 4.25}. It means that if the value of WFC_T for any respondent is v and $1 \le v < 1.5$, then v is considered as 0. If $1.5 \le v < 4.25$, then v is considered as 1 and if $v \ge 4.25$, it is considered as 2. Similarly, as per MD heuristic, these discretization or range values for WFC_S={2.25, 3.75}; for FWC_T={ 1.75, 3.75}; for FWC_S= { 2.25, 4.25}; for WFE1={ 1.17, 3.5}; for WFE3={ 2.17, 4.17}; for FWE1={ 1.83, 4.17} and for FWE2= { 2.17, 3.83}. These ranges are not obtained for WFC_B, FWC_B, WFE2 and FWE3 as these attributes are found to be dispensable, which is mentioned in the next subsection.

Dispensable attributes are removed

Applying MD heuristics, it was found that attributes (features) WFC_B and FWC_B are dispensable for Table 3 and WFE2 and FWE3 are dispensable for Table 4 and the remaining attributes are indispensable. The modified versions of Table 3 and Table 4, as per RST based rule generation, are shown in Table 5 and Table 6, respectively. Dispensable attributes are removed from these tables.

Decision rules are generated from the final reduced information table

The decision rules can be formed from Tables 5 and Table 6 and the rules are shown in Table 7. These rules are tested on the remaining 200 responses to judge the validity of the use of the RST based rule generation in this case. The performances are shown as the confusion matrices. The confusion matrices are shown in Tables 8, 9 and 10. Form the confusion matrices, if is evident that the rules obtained from RST are performing well on the unseen data of the remaining 200 respondents to predict the levels of OC and OCB, since, the accuracy of such predictions for all of the cases are high (i.e., greater than 96%).

Table 5. Modified form of Information Table 3 for RST based rule generation

Object	Condition Attributes						Decision Attribute1 (OC)	Decision Attribute2 (OCB_I)	Decision Attribute3 (OCB_O)
	WFC_T	WFC_S	WFC_B	FWC_T	FWC_S	FWC_B			
1	1	2	-	2	1	-	0	0	0
2	1	1	-	1	1	-	1	0	0
3	1	2	-	2	1	-	0	0	0
4	2	2	-	2	0	-	0	0	1
5	2	2	-	2	1	-	0	0	0
6	1	2	-	1	1	-	0	0	0
. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
398	0	1	-	0	0	-	1	1	0
399	1	0	-	1	0	-	1	1	1
400	1	1	-	0	0	-	1	1	1
401	1	0	-	0	0	-	0	1	1
402	1	2	-	0	0	-	1	1	0
403	1	1	-	0	0	-	1	1	0

Table 6. Modified form of Information Table 4 for RST based rule generation

Object	Condition Attributes						Decision Attribute1 (OC)	Decision Attribute2 (OCB_I)	Decision Attribute3 (OCB_O)
	WFE1	WFE2	WFE3	FWE1	FWE2	FWE3			
1	0	-	0	1	0	-	0	0	0
2	0	-	0	1	0	-	1	0	0
3	0	-	0	1	1	-	0	0	0
4	1	-	0	1	1	-	0	0	1
5	0	-	0	0	1	-	0	0	0
6	1	-	0	0	0	-	0	0	0
. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
398	2	-	1	1	1	-	1	1	0
399	1	-	2	2	2	-	1	1	1
400	2	-	1	2	2	-	1	1	1
401	2	-	2	2	1	-	0	1	1
402	2	-	2	2	0	-	1	1	0
403	2	-	2	2	2	-	1	1	0

Table 7. Some of the Consistent Decision Rules obtained from the RST based analysis of the information tables of responses

Decision Rule Sets	Statement of the Rule	
	IF	THEN
Between WFC, FWC & OC	(WFC_T=1 ∧ WFC_S=2 ∧ FWC_T=2∧ FWC_S=1) ∨ (WFC_T=2 ∧ WFC_S=2 ∧ FWC_T=2 ∧ FWC_S=0) ∨ (WFC_T=2 ∧ WFC_S=2 ∧ FWC_T=2 ∧ FWC_S=1) ∨ (WFC_T=1 ∧ WFC_S=2 ∧ FWC_T=1 ∧ FWC_S=1)	OC is 0, i.e., OC is not greater than 3 i.e., OC is low
	(WFC_T=1 ∧ WFC_S=1 ∧ FWC_T=1∧ FWC_S=1) ∨ (WFC_T=0 ∧ WFC_S=1 ∧ FWC_T=0 ∧ FWC_S=0) ∨ (WFC_T=1 ∧ WFC_S=0 ∧ FWC_T=1 ∧ FWC_S=0) ∨ (WFC_T=1 ∧ WFC_S=1 ∧ FWC_T=0 ∧ FWC_S=0) ∨ (WFC_T=1 ∧ WFC_S=2 ∧ FWC_T=0 ∧ FWC_S=0)	OC is 1, i.e., OC is greater than 3 i.e., OC is high
Between WFC, FWC & OCB_I	(WFC_T=1 ∧ WFC_S=2 ∧ FWC_T=2∧ FWC_S=1) ∨ (WFC_T=1 ∧ WFC_S=1 ∧ FWC_T=1 ∧ FWC_S=1) ∨ (WFC_T=2 ∧ WFC_S=2 ∧ FWC_T=2 ∧ FWC_S=0) ∨ (WFC_T=2 ∧ WFC_S=2 ∧ FWC_T=2 ∧ FWC_S=1) ∨ (WFC_T=1 ∧ WFC_S=2 ∧ FWC_T=1 ∧ FWC_S=1)	OCB_I is 0, i.e., OC is not greater than 3 i.e., OC is low
	(WFC_T=0 ∧ WFC_S=1 ∧ FWC_T=0∧ FWC_S=0) ∨ (WFC_T=1 ∧ WFC_S=0 ∧ FWC_T=1 ∧ FWC_S=0) ∨ (WFC_T=1 ∧ WFC_S=1 ∧ FWC_T=0 ∧ FWC_S=0) ∨ (WFC_T=1 ∧ WFC_S=0 ∧ FWC_T=0 ∧ FWC_S=0) ∨ (WFC_T=1 ∧ WFC_S=2 ∧ FWC_T=0 ∧ FWC_S=0)	OCB_I is 1, i.e., OC is greater than 3 i.e., OC is high
Between WFC, FWC & OCB_O	(WFC_T=1 ∧ WFC_S=2 ∧ FWC_T=2∧ FWC_S=1) ∨ (WFC_T=1 ∧ WFC_S=1 ∧ FWC_T=1 ∧ FWC_S=1) ∨ (WFC_T=2 ∧ WFC_S=2 ∧ FWC_T=2 ∧ FWC_S=1) ∨ (WFC_T=1 ∧ WFC_S=2 ∧ FWC_T=1 ∧ FWC_S=1) ∨ (WFC_T=0 ∧ WFC_S=1 ∧ FWC_T=0 ∧ FWC_S=0)	OCB_O is 0, i.e., OC is not greater than 3 i.e., OC is low

Decision Rule Sets	Statement of the Rule	
	IF	THEN
	(WFC_T=2 ∧ WFC_S=2 ∧ FWC_T=2∧ FWC_S=0) ∨ (WFC_T=1 ∧ WFC_S=0 ∧ FWC_T=1 ∧ FWC_S=0) ∨ (WFC_T=1 ∧ WFC_S=0 ∧ FWC_T=0 ∧ FWC_S=0) ∨	OCB_O is 1, i.e., OC is greater than 3 i.e., OC is high
Between WFE, FWE & OC	(WFE1=0 ∧ WFE3=0 ∧ FWE1=1∧ FWE2=1) ∨ (WFE1=1 ∧ WFE3=0 ∧ FWE1=1∧ FWE2=1) ∨ (WFE1=0 ∧ WFE3=0 ∧ FWE1=0∧ FWE2=1) ∨ (WFE1=1 ∧ WFE3=0 ∧ FWE1=0∧ FWE2=0)	OC is 0, i.e., OC is not greater than 3 i.e., OC is low
	(WFE1=2 ∧ WFE3=1 ∧ FWE1=1∧ FWE2=1) ∨ (WFE1=1 ∧ WFE3=2 ∧ FWE1=2∧ FWE2=2) ∨ (WFE1=2∧ WFE3=1 ∧ FWE1=2∧ FWE2=2) ∨ (WFE1=2 ∧ WFE3=2 ∧ FWE1=2∧ FWE2=0) ∨ (WFE1=2 ∧ WFE3=2 ∧ FWE1=2∧ FWE2=2)	OC is 1, i.e., OC is greater than 3 i.e., OC is high
Between WFE, FWE & OCB_I	(WFE1=0 ∧ WFE3=0 ∧ FWE1=1∧ FWE2=0) ∨ (WFE1=0 ∧ WFE3=0 ∧ FWE1=1∧ FWE2=1) ∨ (WFE1=1 ∧ WFE3=0 ∧ FWE1=1∧ FWE2=1) ∨ (WFE1=0 ∧ WFE3=0 ∧ FWE1=0∧ FWE2=1) ∨ (WFE1=1 ∧ WFE3=0 ∧ FWE1=0∧ FWE2=0)	OCB_I is 0, i.e., OC is not greater than 3 i.e., OC is low
	(WFE1=2 ∧ WFE3=1 ∧ FWE1=1∧ FWE2=1) ∨ (WFE1=1 ∧ WFE3=2 ∧ FWE1=2∧ FWE2=2) ∨ (WFE1=2∧ WFE3=1 ∧ FWE1=2∧ FWE2=2) ∨ (WFE1=2∧ WFE3=2 ∧ FWE1=2∧ FWE2=1) ∨ (WFE1=2 ∧ WFE3=2 ∧ FWE1=2∧ FWE2=0) ∨ (WFE1=2 ∧ WFE3=2 ∧ FWE1=2∧ FWE2=2)	OCB_I is 1, i.e., OC is greater than 3 i.e., OC is high
Between WFE, FWE & OCB_O	(WFE1=0 ∧ WFE3=0 ∧ FWE1=1∧ FWE2=0) ∨ (WFE1=0 ∧ WFE3=0 ∧ FWE1=1∧ FWE2=1) ∨ (WFE1=0 ∧ WFE3=0 ∧ FWE1=0∧ FWE2=1) ∨ (WFE1=1 ∧ WFE3=0 ∧ FWE1=0∧ FWE2=0) ∨ (WFE1=2 ∧ WFE3=1 ∧ FWE1=1∧ FWE2=1)	OCB_O is 0, i.e., OC is not greater than 3 i.e., OC is low
	(WFE1=1 ∧ WFE3=2 ∧ FWE1=2∧ FWE2=2) ∨ (WFE1=2∧ WFE3=1 ∧ FWE1=2∧ FWE2=2) ∨ (WFE1=2 ∧ WFE3=2 ∧ FWE1=2∧ FWE2=1)	OCB_O is 1, i.e., OC is greater than 3 i.e., OC is high

As mentioned earlier, " is logical "AND" and " is logical "OR" operators.

Table 8. Confusion Matrix obtained from the testing the rule base between WFC, FWC, WFE, FWE & OC, where OC is the decision attribute

	Predicted			
Actual		0	1	Accuracy
	0	102	4	96.22%
	1	2	92	97.87%

Table 9. Confusion Matrix obtained from the testing the rule base between WFC, FWC, WFE, FWE & OCB_I, where OCB_I is the decision attribute

	Predicted			
Actual		0	1	Accuracy
	0	98	3	97.02%
	1	2	97	97.97%

Table 10. Confusion Matrix obtained from the testing the rule base between WFC, FWC, WFE, FWE & OCB_O, where OCB_O is the decision attribute

	Predicted			
Actual		0	1	Accuracy
	0	99	2	98.02%
	1	2	97	97.97%

Managerial Implications

Work-family enrichment (WFE) occurs when experiences in one domain positively influence performance in another. Employees who experience WFE tend to demonstrate increased job satisfaction, motivation, and engagement in discretionary behaviors that benefit the organization.

Organizational Citizenship Behavior (OCB) encompasses voluntary actions beyond formal job descriptions, such as assisting colleagues, showing initiative, and displaying organizational loyalty. Employees with high WFE often exhibit stronger OCB due to their enhanced well-being and resource accumulation across work and family domains.

RST helps in identifying the key attributes that contribute to the link between WFE and OCB. By analyzing employees' work-family dynamics, organizations can develop strategies. Moreover, the advantage of using Rough Set Theory (RST) becomes evident in scenarios where collecting large amounts of employee data is challenging. In this approach, rule-based analysis allows for the estimation of Organizational Commitment (OC) and Organizational Citizenship Behavior (OCB) using data obtained from Work-Family Enrichment (WFE) and Work-Family Conflict (WFC) measurement instruments. Moreover, through Rough Set Theory, we can analyze patterns in employees' responses to WFC and identify underlying trends. By distinguishing employees who maintain their commitment despite WFC from those who disengage, organizations can develop targeted interventions to mitigate conflict and strengthen commitment. The extracted decision rules provide actionable insights for managers and policymakers.

Conclusion and Future Research Directions

This study highlights the significance of applying Rough Set Theory (RST) to examine the intricate relationships between work-family conflict, work-family enrichment, organizational citizenship behavior, and organizational commitment. By leveraging RST, organizations can uncover complex and subtle patterns and develop evidence-based interventions to achieve a better work-life balance. Thus, Rough Set Theory presents a promising approach for analyzing relationships and impacts among various parameters.

Future research can further expand on these findings by integrating additional variables, such as job satisfaction, psychological well-being, and industry-specific factors.

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