# Designing Artificial Intelligence/International Relations (AI/IR) Platform: Foreign Policy Decision-Making Simulation in ASEAN Negotiation

Ratu Ayu Asih Kusuma Putri
International Relations Department
Faculty of Humanities, Bina Nusantara University
Jakarta, Indonesia
ayputri@binus.edu

Tangguh Chairil
International Relations Department
Faculty of Humanities, Bina Nusantara University
Jakarta, Indonesia
tangguh@binus.ac.id

Sukmawani Bela Pertiwi
International Relations Department
Faculty of Humanities, Bina Nusantara University
Jakarta, Indonesia
sukmawani.pertiwi@binus.ac.id

Aninda Rahmasari Tirtawinata
International Relations Department
Faculty of Humanities, Bina Nusantara University
Jakarta, Indonesia
aninda.rahmasari@binus.edu

***Abstract*—The growing interest in artificial intelligence (AI) application into foreign policy decision making and negotiation among scholars and policy-makers demonstrates an inherent transition of International Relations both as a field and practice into the so-called Fourth Industrial Revolution. This study examines the application of AI in providing a computerized decision-making support system and how the production of such a system would assist both practitioners and learners of International Relations in understanding the state's foreign policy decision making process and strategies during diplomatic negotiations. This study offers a design of AI/IR systems which adopts the Expert System framework and employs the strategy of Forward Chaining. This study provides a framework for developing a rule-based system to identify possible foreign policy alternatives and their consequences by adopting the Rational Choice model as the basis of knowledge engineering. Given the remarkable growth of the Southeast Asia region in recent years, this study is particularly interested in developing a computerized decision-making system that can promptly respond to the region's dynamics.**

***Keywords—artificial intelligence; the foreign policy decision-making process; International Relations; ASEAN;***

## I. INTRODUCTION

In recent years, there has been a significantly increased attention on the so-called Fourth Industrial Revolution, a phenomenon which postulates the dramatic technological change transforming the industries and parts of society [1]. Fourth Industrial Revolution – a term coined by Klaus Schwab [2] in his book – is commonly viewed as an evolution of social norms and political attitudes due to the emerging technological advances which affect economic development and international relations [3].

Correspond to this development, the International Relations study has seen the importance of incorporating technologies to both the conduct and learning of international relations. An increasing number of scholars in the field have attempted to observe how technological development affects the foreign policy decision-making process and the behavior of international relations actors, mainly using Artificial Intelligence [4] [5] [6]. Artificial Intelligence (hereafter AI) is a computer programming that emulates human intelligence aspects such as reasoning, perception, planning, problem-solving, and language understanding [4]. AI inherently offers a platform to explain an actor's behavior more efficiently by operationalizing the pre-determined rules built out of a big dataset.

A relatively late-comer field in AI application, International Relations' interest in integrating the technology is ubiquitous in the foreign policy decision-making process. In the formulation of foreign policy, a decision-maker delineates a portfolio of alternatives developed from various sources to achieve the actor's utmost interests. Therefore, the core agenda of foreign policy analysis consists of the activity of planning and the construction of strategic plans predicated on the plans of other actors [5]. That said, the potential of AI/IR in supporting the agenda of foreign policy analysis is ostensibly huge. It mainly can play a pivotal role in decreasing the time usually consumed to deliberate foreign policy alternatives and calculate their maximum utility.

In practice, the use of foreign policy digital simulator is still inherently rare. Amidst its promise to deliver speedy and accurate tailored strategies to achieve political goals or address the crisis, a computerized decision support system and simulators for professional diplomats requires further development and examination. Alternatively, International Relations educators have been looking for ways to maximize these emerging technologies' benefits in their classrooms. This said, a holistic study in designing and developing an AI/IR system for both professional and educational purposes seem to be indispensable.

This study is particularly interested in looking at artificial intelligence's potential application in supporting foreign policy decision-making processes in Southeast Asia. In recent years, the region has emerged as a regional powerhouse with its significant development. Despite its notable growth, countries in Southeast Asia continue to experience both

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domestic and regional challenges. Furthermore, such challenges have hindered the establishment of the ASEAN Community, a breakthrough vision to enhance regional integration. Most importantly, a digitalized decision making platform which can support decision-makers in ASEAN is certainly underdeveloped.

Against this backdrop, we discuss the role of AI application to understand states' foreign policy decision-making process using the context of ASEAN diplomatic negotiation. This study offers a design of a digital decision support system by providing frameworks that can help produce a portfolio of foreign policy alternatives and calculate each policy's utility. In the following section, we further elaborate on the development of artificial intelligence in International Relations.

## II. Artificial Intelligence in International Relations (AI/IR)

A burgeoning body of literature discusses artificial intelligence (AI) and its use in the social and political field. However, only a limited number of those literature examines the past and current AI developments in International Relations both as a study field and practice closely. Furthermore, analysis on the potential design of AI/IR system is inherently limited in the existing literature. A study by Cummings et al. [7] is an exception that it envisages how AI might fit into international relations and determines the operational tasks for which AI is necessary to support decision-makers. Parakilas and Bryce [8] posit that current foreign policy analysts or policy-makers can reasonably rely on machines to process enormous amounts of data more quickly and accurately. AI systems can also play a pivotal role in the policy analysis through pattern recognition derived from a large dataset.

Correspond to this contemporary development, the manifestation of technology in international relations becomes more likely. There are several models of AI production systems used in International Relations. As noted by Schrodt [9], there is at least three category of AI/IR – a term to describe artificial intelligence research on International Relations. The first category entails research on political reasoning patterns, which include experimental work in cognitive psychology of decision-making. Second, the static model focuses on the rule-based systems (RBS), which is the most common AI/IR model. The simplest form of RBS is the IF-THEN formulations organized into hierarchical trees. The model utilizes a deductive logic to produce a body of rules in the form of operational mathematical statements that constitute theory-based hypotheses [4]. Although RBS provides a capability to simulate political behavior using pre-determined rules, this model has been criticized for its limitation in capturing the policy-making process's actual conduct and complexity. Lastly, the dynamic model attempts to explain the reasoning behind an organization's behavior by using an organization's prior experience. This model promises a greater detail and process validity of the actor's decision. Furthermore, it emphasizes that knowledge is modified, not merely acquired, since actors learn from their past actions. Reactions to a situation are partly based on precedents, and the success or failure of a decision will affect their future actions [9].

Aside from the widespread application of the rule-based systems, Mefford [5] examines the reproduction of rule-based systems into case-based and explanation-based systems. Case-based reasoning (CBR) systems reproduce the process by which political agents identify patterns or paradigms and reapply them in new contexts. It operates by matching the current problem against large structures in memory of previously solved problems or previously encountered situations. Alternatively, AI/IR production can rely on the explanation-based system (EBL) that equips the program with a collection of facts and relationships constituting a 'theory' of some domain. EBL constructs a concept by assembling facts or proof to be added to the knowledge base through generalization [5].

This study's AI/IR system is designed by using primarily the 'Rule-based System' (RBS). RBS operates the 'IF…THEN…' formula to provide a preliminary assessment of foreign policy by identifying possible responses and consequences

## III. Methods

This study adopts the framework provided by the field of expert systems to develop a design of AI/IR system for simulating foreign policy decision making. ES fundamentally captures a problem-solving behavior in real-world domains. It is a computerized program capable of extracting knowledge about a particular problem domain and using inference (reasoning) to arrive at a solution. ES contains factual and heuristic knowledge encompassing some specific areas of human expertise [10][11]. This said, ES assists decision-makers by generating knowledge to solve real-world problems that would otherwise require an expert's interpretation [10]. Furthermore, it is relatively faster in responding to a given situation and can produce generic advice or explain complex problems [10].

The expert systems include some key components [10] [11][12][13]:

- Knowledge Base: an organized collection of facts and expert's domain knowledge, which is built through knowledge engineering.
- Working Memory: a space where problem facts/knowledge of the given case are stored and accumulated. The inference engine continuously fires the rules to the working memory until a final conclusion is produced or confirmed. Information is supplied by the user or as results from the inferencing process.
- Inference Engine: is a problem processing system. It combines the facts of a problem domain with the stored knowledge to draw logical conclusions. Its functions include working with facts, searching the rules for a match, and adding the inference from the rules to the working memory. It also directs the user interface to any information required for inferencing.

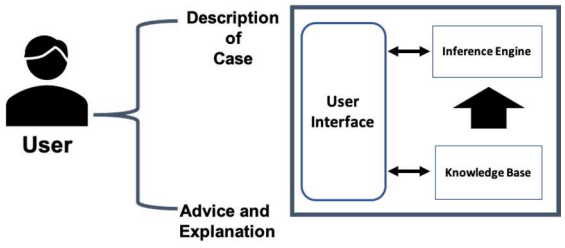


Fig. 1. Components of ES [10]

For this study's purpose, we employ the strategy of forward chaining to improve and develop the inference engine for a rule-based expert system. Forward-chaining applies reasoning through a bottom-up computational model – often used to model the human brain in AI [14]. It is an expert data-driven system that matches known facts stored in the working memory and the condition (IF clause) of each rule in the knowledge base. A rule can be generically defined as an "IF…THEN" structure, which logically relates information in the IF clause to the THEN clause. Such process continues until all possible conclusions are generated [14].

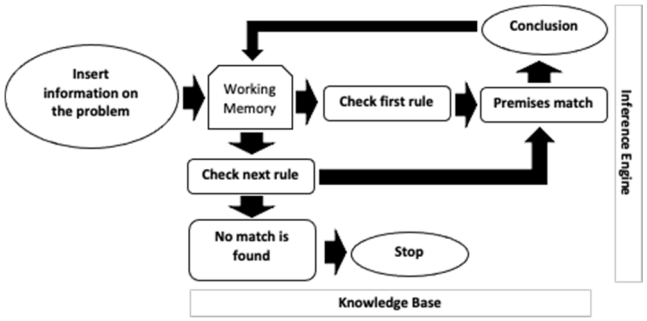


Fig. 2. Forward chaining inference flowchart

At the operational level, forward chaining is inherently a repetition of the following sequence [14]:

*1. Examine rules whose premises (IF clause) match the Working Memory facts until no more rules can be satisfied.*

2. *Add the conclusion (THEN clause) of the inferencing process to the Working Memory.* The decision can turn into a new fact which can subsequently be matched with the remaining rules.

## IV. Results and Discussion

### A. Designing the Knowledge Base and Inference Engine

The first step in designing the AI/IR system intended in this study is to develop frameworks for Working Memory (WM) and Knowledge Base (KB), which can reflect the expert's domain knowledge about foreign policy decision-making process. This study primarily focuses on the use of Rational Choice theory while also adopts other existing frameworks in the study of foreign policy and international politics. Such supporting frameworks are necessary to provide more robust parameters to assess the indicators required in this study.

While there are various theories of the decision-making process in the International Relations study [15], the Rational Choice theory offers a space for mechanical calculation, particularly on the cost and benefit of a foreign policy decision. Nonetheless, the Knowledge Base enhancement feasibility by integrating other foreign policy decision-making models, including – but not limited to – bureaucratic or psychological approaches, is undoubtedly high.

Rational Choice theory presumes that actors will calculate which action/strategy maximizes its utility to attain their goals. Actors also have to consider the moves and countermoves by others since such interplay affects the payoffs in the given decision-making situation [15]. The theory is based on several assumptions:

*1. Actors have desires that they want to achieve.*

2. *Some of these desires are more important to the actors than other desires.* The actors establish rank-order of preferences by attributing different levels of utility to the desires. The rank-ordering is consistent during decision-making situations.

*3. Actors calculate which action maximizes its utility.*

*4. Actors can only calculate the expected utility of an action, including the factor of likelihood and how to deal with them, i.e., whether to be more risk-prone or more risk-averse.*

*5. Actors have strategic behavior, i.e., they try to outwit other actors to maximize their benefits.*

Understanding the state's interests is essential in foreign policy analysis since it determines the range of possible policy gains or losses that ensued from policy-makers' actions [16]. The framework developed by Donald D. Nuechterlein is useful to assess the state's basic interests and the intensity of interests [17]. Such assessment is necessary to identify actors' desires and establish the rank-order of preferences (See assumptions of Rational Choice theory).

Nuechterlein's framework, nevertheless, does not accurately represent the current landscape of international politics. His study has not comprehensively discussed contemporary global issues such as global health insecurity, transnational environmental issue and so on. Hence, for this study, we modify the categorization of basic interests by broadening the perspective of security and adding the term particularly into the defense interest category [17]:

TABLE I. State's Basic Interest Category

| Basic interest | Description | Code | Samples of problem domain |
|---|---|---|---|
| Defense and security | Protection of the state, its system of government, territory, and the citizens against the threat of physical and non-physical violence from another state/actor/entity | A1 | Overt military attack (aggression), invasion, internationalized war, transnational terrorism, use of WMD, transnational organized crimes, transnational environmental issue, global health insecurity, cyber-attack, internal conflict, etc. |
| Economic | Maintaining the well-being of state's economy in relations with other states/actors | A2 | Trade competition, inflation, recession, balance of payment, economic growth issues, competition over emerging markets, energy and the environment problem, economic inequality and financial imbalances, etc. |
| World Order | Maintaining an international political and economic system | A3 | Unequal distribution of power, hegemony, failure of global political leadership, ineffectiveness of international institutions and norms, etc. |
| Ideological | Protection and promotion of state's ideological values | A4 | Ideology-based propaganda, ideology-based transnational socio-political mobilization, naming and shaming at the global level for ideological-related matters, etc. |

[a.] E. Nuechterlein, "National Interests and Foreign Policy: A Conceptual Framework for Analysis and Decision- Making," *British Journal of International Studies,* vol. 2, no. 3, 1976.

There is a possibility that a problem is intertwined with more than one basic interest. Therefore, the AI/IR system must build a clear-cut definition of each problem domain without severely undermining international relations complexities. If one problem comprises multiple basic interests, the system should establish rules that can produce foreign policy alternatives and construct strategic plans targeted to meet all the interests.

Based on the definitions of basic interest in Table 1, we develop rules to fire against the problem domain. We deliberately include international events or trends in the global environment that favorably affect the state's interests. By doing so, the foreign policy outcomes generated by the AI/IR system will include not only problem-solving strategies but also decisions that perpetuate cooperation among states. The rules to conclude A1 – A4 can be classified as below.

| | | |
|---|---|---|
| Rule 1 | IF | [threat of physical or non-physical violence from another actor/state persists] **AND**<br>[threat of physical or non-physical violence from another state/actor/entity to the system of government] **OR**<br>[threat of physical or non-physical violence from another state/actor/entity to the citizens] **OR**<br>[threat of physical or non-physical violence from another state/actor/entity to the territory] **OR**<br>[has a positive impact on the protection of the state, government, territory, and citizens against violence threat from another state/actor]* |
| | THEN | **[basic interest: A1]** |
| Rule 2 | IF | [has adverse impacts on the state's economic well-being] **OR**<br>[has positive impacts on the state's economic well-being]* |
| | THEN | **[basic interest: A2]** |
| Rule 3 | IF | [has adverse impacts to the international political system] **OR**<br>[has adverse impacts to the international economic system] **OR**<br>[has positive impacts to the international political system] **OR**<br>[has positive impacts to the international economic system]* |
| | THEN | **[basic interest: A3]** |
| Rule 4 | IF | [threat to state's ideological values persists] **OR**<br>[has a positive impact on the promotion of state's ideological values]* |
| | THEN | **[basic interest: A4]** |

* positive determinant

Once a basic interest is identified (A1-A4), the next cycle in the forward chaining inference is to determine its intensity (B1- B4). The intensity ranges from 'survival' to 'peripheral' as described below [17].

TABLE II. INTENSITIES OF INTERESTS

| Intensities of interest | Description | Code |
|---|---|---|
| Survival | The existence of the state is in jeopardy due to an immediate threat of massive physical violence from other states/actors | B1 |
| Vital | Serious harm to state's political and economic well-being is likely to occur unless strong measures are undertaken | B2 |
| Major | Political, economy, and ideological security of the state are negatively affected by events and trends in the international environment | B3 |
| Peripheral | Political, economy, and ideological security of the state is not negatively affected by events or trends in the international environment | B4 |

[a] E. Nuechterlein, "National Interests and Foreign Policy: A Conceptual Framework for Analysis and Decision- Making," *British Journal of International Studies,* vol. 2, no. 3, 1976.

Nuechterlein's framework measures the intensity of interest by examining the values and costs of an occurring problem (Table 3). Values are indicators that are assessed by decision-makers when they are deliberating events and issues in the international environment and identifying the state's national interests. In addition to values, policy-makers need to consider the potential costs of continuing the dispute with other states/actors [17].

TABLE III. INDICATORS OF VALUES AND COSTS

| Values | Costs |
|---|---|
| 1. Proximity of danger | 1. Economic costs of conflict |
| 2. Nature of the threat | 2. The number of troops needed |
| 3. Economic stake | 3. The probable duration of hostilities |
| 4. Sentimental attachment | 4. The risks of enlarged conflict |
| 5. Type of government (related to ideological interest) | 5. The likelihood of success |
| 6. Effect on balance of power | 6. The reaction of domestic opinion |
| 7. National prestige | 7. World reaction |
| 8. Attitude of allies and friends | 8. The impact on internal policies |

[a] E. Nuechterlein, "National Interests and Foreign Policy: A Conceptual Framework for Analysis and Decision- Making," *British Journal of International Studies,* vol. 2, no. 3, 1976.

However, each of the values and costs requires a specific measurement tool to generate a valid conclusion. For this purpose, we can utilize some ready-to-use indexes or calculate each component using an assessment model established by other scholars. Some of the examples include global democracy index to determine the type of government (value 5); frameworks to measure state's military (cost 2) and economic strengths (value 3); or a computerized program capable of extracting and mapping the headlines of mass media and trending topics on social media to observe domestic opinion (cost 6).

Measuring each value and cost will require extensive theoretical assessment and cross-tabulation among the indicators. Due to the limitations in time and resources, this study cannot provide a complete structure of rules that can holistically determine the intensity of interests based on the given values and costs. Thus, follow-up research and further examination are necessary to fill in the gap left by this study. However, the following rules might illustrate how the system can determine the intensity of interest:

| | | |
|---|---|---|
| Rule X | IF | [A1] **AND**<br>[Proximity of danger: very close, countries share borders] **AND**<br>[Nature of threat: Immediate, credible threat of massive physical harm by another state] **AND**<br>[Economic stake: very high] **AND**<br>[Type of government: authoritarian] **AND**<br>[Sentimental attachment: shallow to non-existent] |
| | THEN | **[Intensity of interest: B1]** |
| Rule Y | IF | [A2] **AND**<br>[Economic stake: high] **AND**<br>[Effect on balance of power: negative] **AND**<br>[Economic cost of stake: high] **AND**<br>[The impact on internal policies: negative] |
| | THEN | **[Intensity of interest: B2]** |

Based on the above elaboration, Knowledge Base in our AI/IR design is essentially built through the accumulation of three types of data:

- Normative-based data: theory-based problem-solving mechanisms that are correlated with the crisis/case study. It is the primary basis of the rules.
- Pattern-based data: past strategies for similar problem, past treaties/agreements relevant to the problem, and repository of solved problems. This data inherently enhance and complement the normative-based data.
- Factual data: includes geographic information, demographic profile, military strength, economic strength, regime type, terrorism index, democracy index, political freedom index, the use of social media, public opinion.

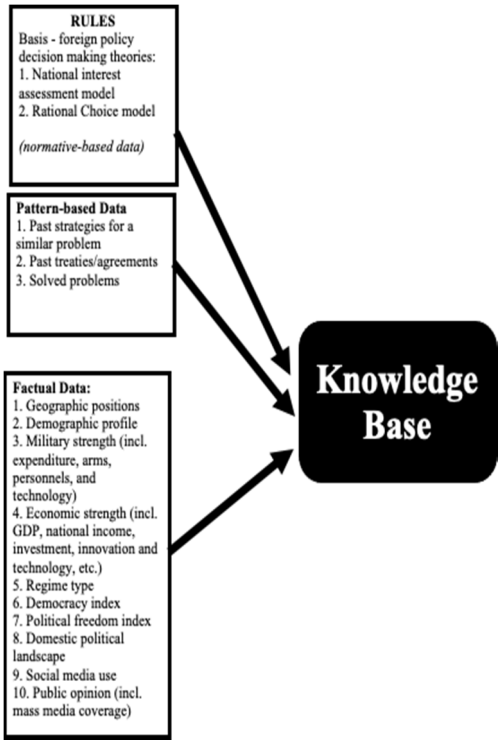


Fig. 3. Knowledge Base (KB) data development model

The sequence of forward chaining inference of the AI/IR system in our design includes two initial cycles: determination of basic interest and intensity. The next step of this study is to build a portfolio of foreign policy alternatives and a computerized system to calculate the utility of each state's decision.

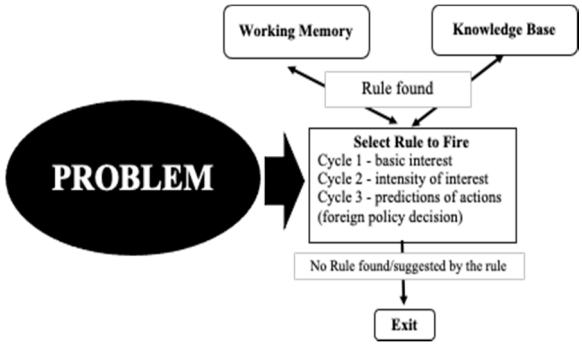


Fig. 4. Forward chaining inference for foreign policy decision making

Since Nuechterlein does not provide a model to predict the course of actions that the state might take to meet its interests [17], we adopt alternative frameworks from the study of foreign policy and international politics – particularly those relevant to the state's foreign policy strategies [15]. Using these frameworks, we build a portfolio of possible foreign policy strategies a state can employ to respond to events or trends in the international environment. Below are some of the rules which can illustrate how Cycle 3 of this AI/IR design might work at the operational level:

| | | |
|---|---|---|
| Rule 5 | IF | [A1] **AND**<br>[B1] **AND**<br>[Immediate threat of massive physical harm by another state/actor] |
| | THEN | **[decision: large-scale military action – weapon of mass destruction (WMD) if necessary]** |
| Rule 6 | IF | [A1] **OR**<br>[A2] **OR**<br>[A3] **OR**<br>[A4] **AND**<br>[B2] **AND**<br>[Diplomatic relations is previously established] **AND**<br>[Cost of hurting diplomatic relations is bearable] |
| | THEN | **[decision: suspension of diplomatic relations - withdrawal of foreign mission]** |
| Rule 7 | IF | [A1] **OR**<br>[A2] **OR**<br>[A3] **OR**<br>[A4] **AND**<br>[B3] **AND**<br>[Cost of hurting diplomatic relations is unbearable] **AND**<br>[All parties equally agree to negotiate] **AND** |
| | THEN | **[decision: diplomatic negotiations]** |

| | | |
|---|---|---|
| Rule 8 | IF | [A1] **OR** |
| | | [A2] **OR** |
| | | [A3] **OR** |
| | | [A4] **AND** |
| | | [B4] **AND** |
| | THEN | **[decision: limited to no engagement**] |
| Rule 9 | IF | [A1] **AND** |
| | | [B2] **AND** |
| | | [State military power > = antagonist military power] **AND** [Cost of military countermeasures is bearable but may harm state's power in the long-run] **AND** |
| | | [Strategic alliance is available] |
| | THEN | **[decision: seek help from allies]** |
| Rule 10 | IF | [A2] **OR** |
| | | [A3] **AND** |
| | | [B2] **AND** |
| | | [State's economic power > antagonist's economic power] **AND** |
| | THEN | **[decision: impose economic sanction]** |
| Rule 11 | IF | [A3] **AND** |
| | | [A1] **AND** |
| | | [B2] **AND** |
| | | [Antagonist's reliance on its arms trade and industry] **AND** |
| | | [State is independent from antagonist's arms trade and industry] **AND** |
| | THEN | **[decision: impose arms embargo]** |
| Rule 12 | IF | [A3] **AND** |
| | | [B3] **AND** |
| | | [State's sufficient capacity to provide humanitarian aid - no harm to domestic politics and economy] |
| | THEN | **[decision: provide humanitarian assistance - funding, personnel or materials]** |
| Rule 13 | IF | [A3] **AND** |
| | | [B2] **AND** |
| | | [Treaty/agreement is harmful to state's political and economic well-being] **AND** |
| | | [Cost of losing membership privileges and advantages is bearable] |
| | THEN | **[decision: withdraw from treaty/agreement]** |

The above rules are certainly not exhaustive. Numerous outcomes can be produced from the combination of facts generated from the previous cycles and new facts on the problem domain stored in the Working Memory.

The Rational Choice model prescribes that as the portfolio of alternatives is developed, the subsequent decision-making process is to order those alternatives according to the policy-makers' preferences. The intensity of policy-makers' preferences is defined as utility [18]. Once the rank-order of preferences is established, actors calculate the expected utility of each possible action [15]. Rational decision-makers essentially select action that yields the highest expected utility, thus maximize their benefits.

Expected utility theory is adopted in this study to provide a framework to rank the choice-worthiness of state policies. In this sense, the higher the expected utility, the better it is to take the policy [19]. To calculate each policy's expected utility, policy-makers have to map a set of policies into a set of outcomes. Also, we should identify the states that are things outside the decision-makers' control, which can influence the decision's outcome. Each policy is expected to match with one outcome. The correlation between policies and outcomes can be generally formulated in the following function [20]:

$$m: \ \Pi \rightarrow \Omega$$

m : function that maps the policy space into outcome space
$\prod$: set of policies
$\Omega$ : set of outcomes

The expected utility (EU) of a foreign policy can be defined as:

$$EU(FP) = \sum_{\omega \in \Omega} PFP(\omega)\, U(\omega)$$

Where FP is foreign policy, ω is the outcome, PFP (ω) is the probability of outcome ω conditional on FP, and U(ω) is the utility of ω.

According to the Rational Choice theory, policy-makers will always try to yield the highest payoff. To do so, they select a foreign policy (FP*) that will produce the most desired outcome (ω*). Therefore, maximum expected utility is obtained when policy FP* is taken:

$$\Omega(FP^*) = \omega^*$$

FP* $\in \prod$: a policy within the policy space
ω* $\in \Omega$: an outcome within the outcome space

As the parameter to calculate each foreign policy alternative's expected utility has been identified, the next step in this study is to develop rules that can depict the framework. Below is an illustration of such rules:

| | | |
|---|---|---|
| Rule R | IF | [FP] **AND** |
| | | [Probability of states – P(s)] **AND** |
| | | [Utility of outcome ω1 – U(ω1)] **AND** |
| | | [Utility of outcome ω2 – U(ω2] **AND** |
| | | [Utility of outcome ω3 – U(ω3] **AND** |
| | | [Utility of outcome ω4 – U(ω4)] |
| | THEN | **[Expected utility of foreign policy relative to the opposite policy – EU(FP) vs. EU(FP')]** |
| Rule S | IF | [FP] **AND** |
| | | **[**Expected utility of foreign policy relative to the opposite policy – EU(FP) vs. EU(FP')] |
| | THEN | **[foreign policy is advised/not advised]** |

The challenge in developing these rules can be seen as twofold. First, each policy has to be treated as independent and provided with its own set of expected utility framework. Second, the EU framework for each policy might vary from one actor to another. For instance, the probability of states and the utility of outcome for policy A is different between Indonesia and Singapore. Consequently, the AI/IR system rules may need to be specified if more than one actor is to be assessed. Moreover, the size of data will be exponentially enlarged.

Referring to the inferencing process result, actors can enter the negotiation table with a portfolio of foreign policy alternatives, including their rank-order of preferences. This portfolio will assist policy-makers in pursuing their most desirable outcomes. Actors enter a negotiation table when their interests are entwined over a particular concern or issue. Negotiation in a diplomatic setting involves an interplay of common and conflicting interests between actors. It is a political process involving at least two parties trying to combine their opposing points of view into a mutually acceptable decision [21].

*B. Simulation in ASEAN Negotiation*

This sub-section illustrates the operationalization of the overall AI/IR design elaborated in this study using a regional problem faced by countries in Southeast Asia. The initial design depicted in the previous sub-section includes all possible policies any states can take. However, some foreign policy strategies might not be applicable in the context of ASEAN. For instance, the use of weapons of mass destruction (WMD) might be irrelevant since there is no ASEAN country possessing such weapons.

To illustrate the application of our AI/IR system in ASEAN negotiation, we are using the case of transboundary haze pollution as an example. Assume that we are foreign policy decision-makers of Singapore facing a problem of transboundary haze pollution caused by a large-scale forest fire in Sumatra, Indonesia. The occurring brought harmful effects on citizens' health, negative impacts on the environment, tourism, and business, and strained the relations among ASEAN member countries.

First, we insert the information about the problem into the system, and the information is compared with the premises of the first batch of rules (R1-R4). Accordingly, we find a match between the R1, R2, and R3 premises and the problem's information. The conclusion of R1, R2, and R3 demonstrates that the problem of transboundary haze pollution relates to multiple basic interests - A1 (defense and security), A2 (economic), and A3 (world order). These conclusions are added to the working memory.

The system will then check the intensity of interests using rules Ri-Rn (have not developed in this study). Assuming that this inferencing process's conclusions are as follows: A1 – vital, A2 – major, A3 – major, the system can proceed with the remaining rules to determine a set of actions that Singapore can take to respond to the problem. The system will then check all the remaining rules until all possible conclusions are generated. The suggested foreign policy alternatives are suspension of diplomatic relations (with Indonesia), diplomatic negotiations, and withdrawal from treaty/agreement/organization (relevant to transboundary haze pollution.

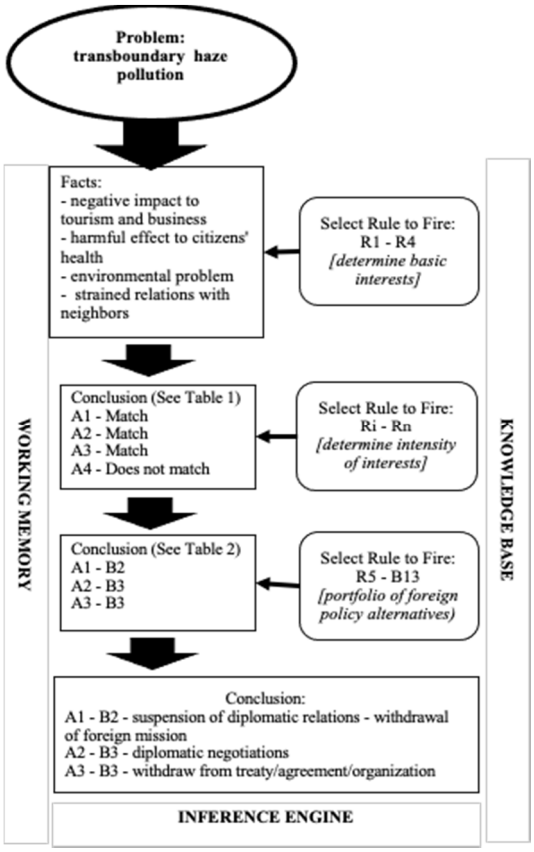


Fig. 5. Foreign policy decision-making sample flowchart

Using the Rational Choice model in this example, Singapore examines the expected utility of each suggested action. Consider withdrawal from ASEAN Agreement on Transboundary Haze Pollution (AATHP) as an example, and given there is a much higher probability of forest fire to occur in Indonesia ($P_{fire} > P_{nofire}$) due to various factors.

TABLE IV. EXPECTED UTILITY MATRIX

| | | **States** | |
|---|---|---|---|
| | | ***forest fire (P = 0,7)*** | ***no forest fire (P = 0.3)*** |
| **Foreign Policy** | Stay in agreement on transboundary haze pollution | affected by the haze pollution, mitigation support (U = 5) | no pollution, responsible for providing mitigation support (U = 5) |
| | Withdraw from the agreement on transboundary haze pollution | affected by the haze pollution, no mitigation support (U = 0) | no pollution, no funding/mitigation responsibility (U = 10) |

The expected utility of staying in the agreement can be measured as below:

$$EU(stay) = FP_{stay}\text{ (affected by pollution, mitigation support) } . 5 + FP_{stay}\text{ (affected by pollution, no mitigation support) } . 0 + FP_{stay}\text{ (no pollution, no funding/mitigation responsibility) } . 10 = 5$$

While the expected utility of withdrawing from the agreement is:

$$EU(\text{withdraw}) = FP_{\text{withdraw}}(\text{affected by pollution, mitigation support}) \cdot 5 + FP_{\text{withdraw}}(\text{affected by pollution, no mitigation support}) \cdot 0 + FP_{\text{withdraw}}(\text{no pollution, no mitigation responsibility}) \cdot 10 = 3$$

Since EU(stay) > EU(withdraw), Singapore's rational choice should be staying in the agreement.

| | | |
|---|---|---|
| Rule T | IF | [Decision: withdraw from treaty/agreement] **AND** [Probability of forest fire > probability of no forest fire] **AND** [Outcome of staying in the agreement with forest fire = 5] **AND** [Outcome of staying in the agreement with forest fire = 5] **AND** [Outcome of withdrawal from the agreement with forest fire = 0] **AND** [Outcome of withdrawal from the agreement with no forest fire = 10] |
| | THEN | **[Expected utility is lower than staying in the agreement]** |
| Rule U | IF | [Decision: withdraw from treaty/agreement] **AND** [Expected utility is lower than staying in the agreement] |
| | THEN | **[foreign policy is not advised]** |

Based on this result, Singapore policy-makers are more likely to propose an improvement of AATHP as opposed to abandoning the agreement. Furthermore, with a comprehensive understanding of their interests and the intensity, Singapore might approach other ASEAN countries that share the interests and policy preferences. Technically, the end-result of negotiation is a decision generated from an aggregation of participating countries' policy recommendations.

## V. CONCLUSIONS

The AI/IR system has been directly or indirectly manifested in various digital-based platforms. Despite the target users may not be International Relations practitioners or learners, the goals can still be achieved – as in war simulation game or decision-making strategies. We found that designing such a system requires some essential steps. First is the holistic understanding of the foreign policy decision-making process and the related theoretical frameworks. Second, the ability to collect a large set of data and build a body of rules based on the theoretical framework. Lastly, the platform must model the actual dynamics of the foreign policy decision-making process and diplomatic negotiation.

At this stage, this study inherently has limitations. First, the dataset and rules have not been fully established and described in this article. Second, this study has not actualized the design and evaluated the implementation due to time constraints. Therefore, the system's effectiveness in assisting with the foreign policy decision-making process cannot be measured. Nevertheless, the process of designing is the core of AI/IR development and innovation in this field. Thus, the unavailability of the system's mechanical manifesto has not reduced the importance and contribution of this study.


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