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Why Did Mr. Trump Oppose Globalization? An E-CARGO Approach

Haibin Zhu, *Senior Member, IEEE*

***Abstract*—Everybody knows that Mr. Donald Trump, the 45th President of the United States of America (USA), was against globalization. There are numerous arguments about this topic around the world among renowned politicians and economists. This article presents a new viewpoint from group multirole assignment (GMRA). In this article, we establish a model for simulating the assignment of grand capitals over the world with the help of the Environments—Classes, Agents, Roles, Groups, and Objects (E-CARGO) model and the GMRA model. To support the conclusions, we simulate the situations of globalization and nonglobalization, compare, and analyze the simulation results with a revised GMRA (RGMRA) model. This article contributes a new formalization of a new role assignment problem (RGMRA), a novel way to study globalization, and a clear and evident conclusion that globalization is not beneficial for the USA from the point of view of capital investment.**

***Index Terms*—Computational approach, environments—classes, agents, roles, groups, and objects (E-CARGO), globalization, group role assignment (GRA), Mr. Trump, profit, role-based collaboration (RBC), United States of America (USA).**

Nomenclature

$\mathcal{A}$	Agent (giant capital) set.
$\mathcal{R}$	Role (<industry, country/region>) set.
m	Size of the agent set.
n	Size of the role set.
a_i	Element in $\mathcal{A}$.
r_j	Element in $\mathcal{R}$.
$0 \le i, i_0, i_1, \ldots, < m$	Indices of agents.
$0 \le j, j_0, j_1, \ldots, < n$	Indices of roles.
Q	Qualification matrix, or the ROI value matrix for all the countries in the simulations.
L^a	Agent ability vector (m-dimensional) to inform the maximum number of roles to be assigned.
GRA	Group role assignment.
GMRA	Group multirole assignment.
RGMRA	Revised group multirole assignment.
T	Assignment matrix in GRA.
T^*	Resulted assignment (investment) matrix in globalization.
σ^*	Optimal group performance of RGGRA.
σ_g	Profit collected by all the countries or regions in globalization.
σ_g^{USA}	Profit collected by the USA in globalization.
σ^{USA}	Profit collected by USA without globalization.
Q^{USA}	Profit rate matrix for the USA only.
$T^{\mathrm{USA}*}$	Assignment (investment) matrix for the USA only.
t_d^r	Domestic corporate tax rate.
t_f^r	Corporate tax rate for investments out of the home countries.
σ_g^{USAG}	Gain collected by the USA Government in globalization.
σ^{USAG}	Gain collected by the USA Government without globalization.
t_{fb}^r	Profits used back to the home country/the total profits collected outside the home country.
$\sigma_{\mathrm{gb}}^{\mathrm{USA}}$	Profit collected by the USA after introducing t_{fb}^r with globalization.

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The author is with the Department of Computer Science and Mathematics, Nipissing University, North Bay, ON P1B 8L7, Canada (e-mail: haibinz@nipissingu.ca).

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I. Introduction

WE ARE living in a globalizing world [1]. The 45th President of the United States of America (USA), Mr. Donald Trump, is against globalization [2], and he declared that his opposition was for the benefit of the states [3]. There are many arguments about this idea among renowned politicians and economists, and Green [4] argues that Donald Trump is "not 'antiglobalization"' but to "reorganize the globalization project" in his book.

Globalization is a complex concept, which consists of many extensively connected components, including economic, political, and social areas. It means different to different people [5]. Globalization can be defined as "the spread of products, technology, information, and jobs across national borders and cultures. In economic terms, it describes an interdependence of nations around the globe fostered through free trade" [6]. It can also be defined as "the integration of capital, investment, and labor markets or its integration with world markets" [7].

In this article, we simplify and abstract globalization to "the spread of capitals across national borders," i.e., we concentrate on the aspects of investments of giant capitals in the world because products, technology, information, and jobs can be abstracted to capitals, i.e., money. As for capitals, the fundamental principle is that "capitals are profit-seeking" [8]. To abstract this principle of profits, we can use the maximization of all the profits based on the distributions of the giant capitals [9] in the world.

Role-based collaboration (RBC) [10]–[17] is a computational methodology to investigate collaboration systems. The Environments—Classes, Agents, Roles, Groups, and Objects (E-CARGO) [10]–[17], as the fundamental model of RBC, and GRA with constraints (GRA$^+$) [13]–[16], as one model for role assignment, have been proposed as a well-specified way to simulate social phenomenons [17]. They are a beneficial tool to analyze globalization in the sense of profit and the return of investment (ROI) because globalization is a typical collaboration among different countries in the world.

In this article, we use E-CARGO and GRA$^+$ to simulate globalization in the sense of capital investment, which is a novel way to study globalization. We believe that such a way can reveal the basis for decision-making, including the policy of globalization. To simplify the analysis and simulation, with the concepts of E-CARGO and GRA, we use an equivalent total profit in the U.S. Dollars to express group performance, while capitals are agents, industries in different countries are taken as roles, and the quantity of a specific capital is taken as the ability (power) of an agent.

Even though the simulation in this article seems very simplified, we believe that it keeps the nature of the highly complex concept, i.e., globalization. The conclusions drawn from this article are pertinent and follow a well-known idiom of Chinese, i.e., "大道至简 (Da Dao Zhi Jian)," which means that "the greatest is the simplest." This article contributes a novel approach to analyzing political/economic problems with computations, and an evident conclusion that Mr. Donald Trump's opposition of globalization is for the benefit of the USA.

This article is arranged as follows. Section II introduces briefly the E-CARGO model, which establishes a bridge from globalization to computation. Section III presents the design of the simulations. Section IV presents the simulation results for different conditions. Section V discusses the simulation process and results. Section VI reviews the related work. Finally, this article concludes and points out topics for future work in Section VII.

II. E-CARGO Model in Brief

With E-CARGO [10]–[17], an organization is expressed as a nine-tuple $\sum ::= < C, O, \mathcal{A}, \mathcal{M}, \mathcal{R}, \mathcal{E}, \mathcal{G}, s_0, \mathcal{H} >$, where C, O, $\mathcal{A}$, $\mathcal{M}$, $\mathcal{R}$, $\mathcal{E}$, $\mathcal{G}$, and $\mathcal{H}$ denote limited sets of classes, objects, agents, messages, roles, environments, groups, and human users, respectively, and s_0 denotes the organization's initial state. An organization starts from its initial state and makes progress by following the process of RBC, i.e., role negotiation, agent evaluation, role assignment, role-playing, and role transfer. The application of E-CARGO allows the formal analysis of an organization, a social system, an economic system, or a political system. The relationships between the first-class components of a system, i.e., classes of objects, groups of agents, and environments of roles, can be briefed as follows: one group is built on one environment; a class is composed of one or more objects; a group is composed of one or more agents; and an environment is composed of one or more roles.

To understand the major work of this article, we need to clarify some basic concepts: *roles* can be taken as entities that express both rights and responsibilities, and the role set is denoted as $\mathcal{R}$; *agents* are autonomous entities that can play roles, and the agent set is denoted as $\mathcal{A}$; role (agent) assignment is a tuple of an agent and a role, i.e., $\langle a, r\rangle$ ($a \in \mathcal{A}, r \in \mathcal{R}$); $\mathcal{N}$ denotes the set of nonnegative integers, i.e., $\{0, 1, 2, 3, \ldots\}$; $m \in \mathcal{N}$ ($= |\mathcal{A}|$); $n \in \mathcal{N}$ ($= |\mathcal{R}|$); $i \in \{0, 1, \ldots, m-1\}$ and $j \in \{0, 1, \ldots, n-1\}$ are agent and role indices, respectively; L is a *vector* that represents the numbers of agents required for each role, i.e., $L[j] \in \mathcal{N}$; L^a is a *vector* that represents the numbers of roles to be assigned for each agent, i.e., $L^a[i] \in \mathcal{N}$; Q is the *qualification matrix* that expresses the suitability of an agent for a role, i.e., $Q[i, j] \in [0, 1]$; T is an assignment matrix ($T[i, j] \in \{0, 1\}$), i.e., $T[i, j] = 1$ means that agent i is assigned to role j and $T[i, j] = 0$ means the opposite; $\sigma = \sum_{i=0}^{m-1}\sum_{j=0}^{n-1} Q[i, j] \times T[i, j]$ is called group performance; role j is *workable* if $\sum_{i=0}^{m-1} T[i, j] \geq L[j]$; and T is *workable* if every role j is workable, i.e., $\sum_{i=0}^{m-1} T[i, j] \geq L[j] (0 \leq j < n)$. A group is *workable* if T is workable.

The following definitions are required for conducting the simulations in this article. Please refer to our previous work [10]–[17] for other concepts and definitions related to E-CARGO.

Definition 1 [16]: Given $\mathcal{A}$ ($|\mathcal{A}| = m$), $\mathcal{R}$ ($|\mathcal{R}| = n$), Q, L, and L^a, *GMRA* is to find T to obtain

$$\max\ \sigma = \sum_{j=0}^{n-1}\sum_{i=0}^{m-1} Q[i, j] \times T[i, j]$$

$$\text{s.t. } T[i, j] \in \{0, 1\}, \quad (0 \leq i < m, 0 \leq j < n) \tag{1}$$

$$\sum_{i=0}^{m-1} T[i, j] = L[j], \quad (0 \leq j < n) \tag{2}$$

$$\sum_{i=0}^{n-1} T[i, j] \leq L^a[i], \quad (0 \leq i < m) \tag{3}$$

where (3) indicates the role assignment limits for each agent.

In the new assignment problem, we introduce a new constant γ into the range of T and have the following definition.

Definition 2: Given $\mathcal{A}$ ($|\mathcal{A}| = m$), $\mathcal{R}$ ($|\mathcal{R}| = n$), Q, L^a, and γ, the *RGMRA* problem aims to find a T that obtains

$$\max\ \sigma = \sum_{j=0}^{n-1}\sum_{i=0}^{m-1} Q[i, j] \times T[i, j]$$

$$\text{s.t. (1), (3), and}$$

$$T[i, j] \in \{0, 1, \ldots, \gamma\}, \quad (0 \leq i < m, 0 \leq j < n) \tag{4}$$

where expression (4) indicates the limit number of effort pieces for agent i to put on role j. T $[i, j]$'s are set as integers to follow the GRA formalization, and integers make sense for dealing with billions of dollars, where real numbers are meaningless. It is needed to say that the proposed solution works when T $[i, j]$'s are real numbers.

GMRA and RGMRA both belong to GRA$^+$ because they are derived from the definition of GRA [12]. RGMRA has its own social meaning from the perspective of role assignment, i.e., one agent has limited power (3) (effort or abilities) and can put a limited part (4) of its power to a role if the agent is assigned to the role. Compared with GMRA, RGMRA ignores the constraints specified by L, i.e., constraint (2), but extends the range of variables $T[i, j]$ from $\{0, 1\}$ to $\{0,1,\ldots, \gamma\}$.

We use T^* to represent a feasible T that satisfies Definition 2. Then, we obtain the optimum group performance of RGMRA

$$\sigma^{*}=\sum_{i=0}^{m-1}\sum_{j=0}^{n-1} Q[i, j] \times T^{*}[i, j].$$

RGMRA is a complex problem, which cannot be solved by the algorithm of GMRA [16]. Fortunately, it can be solved with an optimization platform that solves ILP, such as the IBM ILOG CPLEX Optimization Package (CPLEX) [18].

III. Simulation Design

In the capitalization world, we assume that "an invisible hand" [19] (or called the free-market economy law) is driving the giant capitals of the world to optimize their distributions onto industries and collect the maximum profit from all the countries or regions of the world. Please note that there might be a concern that the free-market economy law means that each capital pursues its own maximum profit but not for the overall maximum. In globalization, compared with the number of grand capitals, the number of potential industries for investment is very large. Each grand capital has sufficient choices for choosing the best place for investment, which is consistent with the overall optimization (as shown by the following simulations). With this assumption, RGMRA is a perfect match to conduct such simulations.

In the United Nations, there are 193 official members [20]. The World Trade Organization (WTO) has 164 member states [21]. We can split the main industry branches into 20 categories [22] (see Fig. 1) in a country. We use the top 30 wealthy countries [23] for the capitals to invest and ignore other countries that are not attractive for the capitals to invest. Note that more countries are also simulated, and the results do not affect the conclusion (see Section IV-A).

We use the data (see Table I) from [9] to support our simulation. The grand capitals in the world include 17 giant capitals, each of which holds a fund of more than U.S. \$1 trillion. Note that, in Table I, we split Allianz SE into two parts because it partially belongs to the USA.

We use the ⟨country, industry⟩'s as roles and giant capitals as agents. We use Q $[i, j]$ that means the ROI values (i.e., profit/investment) for giant capital i on the investment jth ⟨country, industry⟩. For each assignment, we mean that agent i invests on ⟨country, industry⟩ the number of \$100 billion (\$100B). We use $m = 18$ and $n = 20 \times 30 = 600$. Roles 0–19 belong to the USA. Other roles belong to other countries or regions.

$L^a = [54\ 44\ 38\ 25\ 24\ 21\ 17\ 14\ 14\ 13\ 13\ 13\ 20\ 28\ 25\ 15\ 13\ 11]$ is used to reflect the number of U.S. \$100 billion (\$100B) for each giant capital (see Table I).

With the above setting, we conduct the RGMRA computation and obtain the best assignment, where $\sigma^* = \sum_{i=0}^{17}\sum_{j=0}^{599} Q[i, j] \times T^*[i, j]$ expresses the

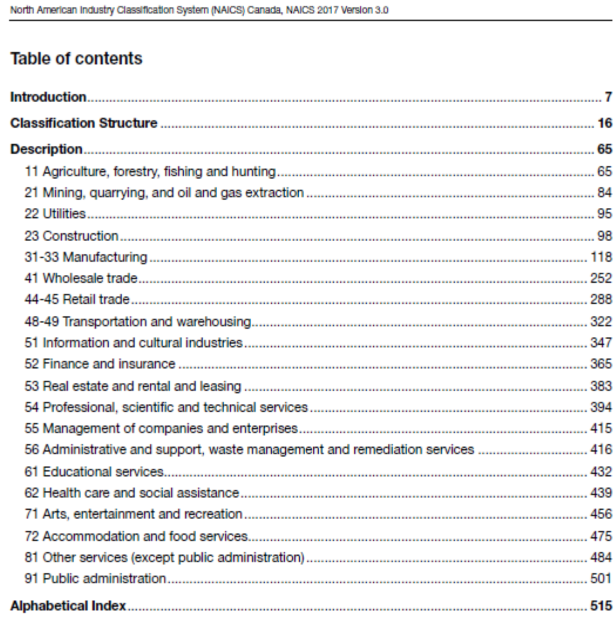
North American Industry Classification System (NAICS) Canada, NAICS 2017 Version 3.0

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Fig. 1. Catalog of industries in North America [22].

TABLE I
Top Giant Capitals in the World (2017) [9]

Agent Index	Name	Country	Assets in management (\$Trillion)
0	BlackRock	USA	5.4
1	Vanguard Group	USA	4.4
2	JP Morgan Chase	USA	3.8
3	Bank of America Merrill Lynch	USA	2.5
4	State Street Global Advisors	USA	2.4
5	Fidelity Investments (FMR)	USA	2.1
6	Bank of New York Mellon	USA	1.7
7	Capital Group	USA	1.4
8	Goldman Sachs Group	USA	1.4
9	Prudential Financial	USA	1.3
10	Morgan Stanley & Co.	USA	1.3
11	Allianz SE (PIMCO)	USA (40%)	1.3
12	Allianz SE (PIMCO)	GERMAN (60%)	2.0
13	UBS	Switzerland	2.8
14	Barclays plc	Great Britain	2.5
15	AXA Group	France	1.5
16	Credit Suisse	Switzerland	1.3
17	Amundi/Credit Agricole	France	1.1

total profit for all the capital investments and $\sigma_g^{\text{USA}} = \sum_{i=0}^{17} \sum_{j=0}^{19} Q[i, j] \times T^*[i, j]$ to mean the profits of the USA, because the capitals out of the USA may invest in the USA.

Note that we need to collect all the profits from all different capitals to the industries of the USA, i.e., $0 \le i < 18$ and $0 \le j < 20$. We conduct a new computation to with the 12×20 matrix Q^{USA}, where $Q^{\text{USA}}[i, j] = Q[i, j](0 \le i < 12, 0 \le j < 20)$, which means that the capitals of the USA need to invest on the industries of the USA and others do not. Such a setting means nonglobalization.

We obtain the best assignment matrix

$$T^{\text{USA}*}(0 \le i < 12, 0 \le j < 20).$$

The new total profits of the USA without globalization are

$$\sigma^{\text{USA}} = \sum_{i=0}^{17} \sum_{j=0}^{19} Q^{\text{USA}}[i, j] \times T^{\text{USA}*}[i, j].$$

To understand the simulation design, we set up an example with 18×600 Q values (ROI values in [0.0, 0.30] annually) in the Supplementary Material, which is too large to present in this article. Agent index 0 means BlackRock, 1 means the Vanguard Group, and so on; and role index 0 means "agriculture, forestry, fishing, and hunting" in the USA, 21 means "mining, quarrying, and oil and gas extraction" in China, 42 means "utilities" in Japan, and so on.

With the given Q matrix, we get a sparse T matrix, which is shown in the Appendix and the translations by globalization. Under the situation of nonglobalization, Q^{USA} and $T^{\text{USA}*}$ are also presented in the Appendix with data and translations.

With globalization, the USA collects its profit of U.S. \$1.4T; 30 countries or regions together collect the U.S. \$12.60T. However, the USA collects a profit of U.S. \$8.386T without globalization.

From the results shown in the Appendix, we notice that all the investments choose the best ROI value, i.e., 30%. However, the capitals in nonglobalization need to take lower ROI values in a range of [0.26, 0.30].

From this special example, we can get an initial conclusion that globalization is not beneficial for the USA. In Section IV, we use hundreds of random Q's to verify the generality of this conclusion.

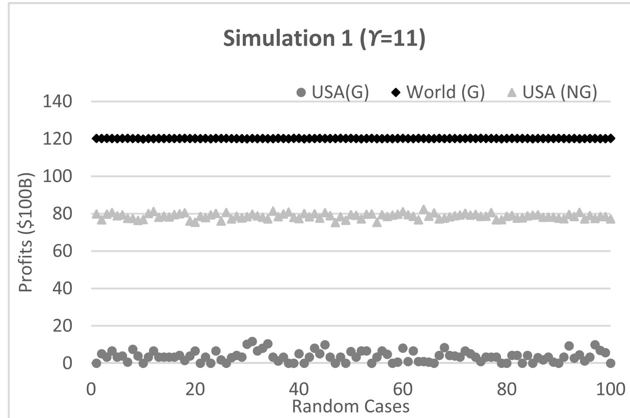
IV. Simulation Experiments

A. Simulation 1 With Random Data

The Q matrix is created by evenly assigning random numbers in [0, 0.3], which means that the investment environments are evenly randomized with the same probabilities in the 30 selected countries or regions.

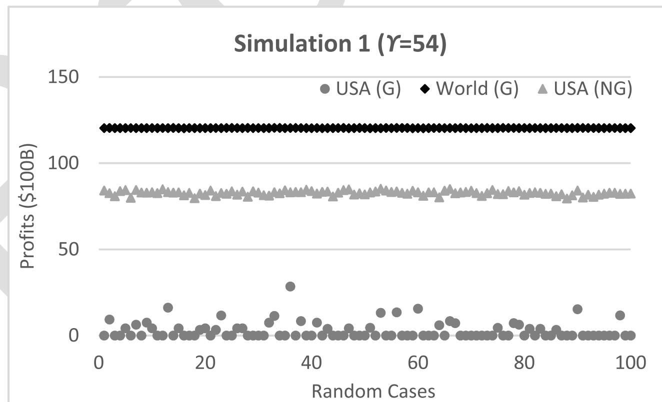
We use 100 Q matrices (see Figs. 2–4) to compute and take the maximum, minimum, and average profits shown and Tables II–IV. To check the impact of parameter γ, which means the maximum allowed amount of investment in industry. We choose $\gamma = 11 = \min\{L^a[i]\ (0 \le i < m)\}$, $54 = \max\{L^a[i]\ (0 \le i < m)\}$, or $32 = \text{average}\{L^a[i]\ (0 \le i < m)\}$.

To understand Tables II–IV, σ_g^{USA} means the partial profits obtained by the USA with globalization, and σ^{USA} means the



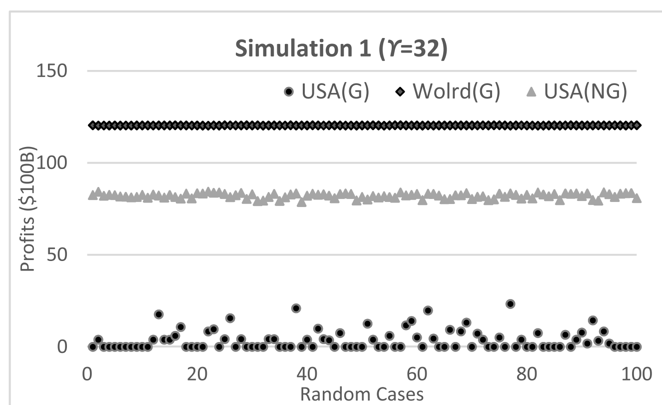
Note: G: Globalization, NG: Non-Globalization.

Fig. 2. Simulation 1 with $\gamma = 11$.



Note: G: Globalization, NG: Non-Globalization.

Fig. 3. Simulation 1 with $\gamma = 54$.



Note: G: Globalization, NG: Non-Globalization.

Fig. 4. Simulation 1 with $\gamma = 32$.

profits obtained by the USA with nonglobalization. We can obtain an evident conclusion, i.e., nonglobalization is better for the USA, because more profits are kept in the USA. We will consider taxes in the third simulations to understand the government gain in such investments.

As for the impact of parameter γ, we did not recognize a significant difference. A number between $\max\{L^a[i]\ (0 \le i < m)\}$ and $\min\{L^a[i]\ (0 \le i < m)\}$ is fine in

TABLE II
TOTAL PROFITS IN SIMULATION 1 (U.S. $100B, $\gamma = 11$)

γ= 11	S_g^{USA}	S^*	S^{USA}
Average	3.62	120.23	78.66
Max	11.67	120.35	82.34
Min	0.00	119.96	75.27

TABLE III
TOTAL PROFITS IN SIMULATION 1 (U.S. $100B, $\gamma = 54$)

γ= 54	S_g^{USA}	S^*	S^{USA}
Average	2.78	120.40	82.72
Max	28.45	120.51	85.16
Min	0.00	120.29	79.50

TABLE IV
TOTAL PROFITS IN SIMULATION 1 (U.S. $100B, $\gamma = 32$)

γ= 54	S_g^{USA}	S^*	S^{USA}
Average	3.58	120.38	82.08
Max	23.32	120.48	84.39
Min	0.00	120.25	78.69

the simulation. The simulation result informs that the capital will invest all the allowed amount on in the industry with the highest ROI values (see the example mentioned in Section IV and presented in the Appendix).

In fact, we also conduct a simulation by using $m = 18$ and $n = 20 \times 164$ (the members of WTO) $= 3280$. Roles 0–19 belong to the USA. Other roles belong to other members. $Q[i, j]$'s are set with [0.0, 0.3] $(0 \le i < 18, 0 \le j < 164)$

$$\sigma^* = \sum_{i=0}^{17}\sum_{j=0}^{3279} Q[i, j] \times T^*[i, j]$$

$$\sigma_g^{\mathrm{USA}} = \sum_{i=0}^{17}\sum_{j=0}^{19} Q[i, j] \times T^*[i, j], \quad \text{and}$$

$$\sigma^{\mathrm{USA}} = \sum_{i=0}^{17}\sum_{j=0}^{19} Q^{\mathrm{USA}}[i, j] \times T^{\mathrm{USA}*}[i, j].$$

The average profit collected by the USA with globalization is decreased compared with those in the 18×600 assignment matrix. Others have not many changes. These results are reasonable because capitals have more and better choices outside the USA.

B. Simulation 2 With the Assumed Investment Environments

In this simulation, we suppose that the investment environment in the USA is generally better than those in other countries, which is reflected by the range of random ROI values.

We set $Q[i, j]$ $(0 \le i < 18, 0 \le j < 20)$ with different ROIs in ten different ranges: staring by [0.01, 0.30] to [0.00, 0.40], with steps of 0.01; we set other $Q[i, j]$'s with [0.0, 0.3] unchanged $(0 \le i < 18, 20 \le j < 60)$, and $\gamma = 54$. In each step, we use 100 Q matrices to compute and take the maximum, minimum, and average profits.

We obtain an interesting result (see Table V), i.e., if the investment environment of the USA is a little bit better than the other countries, i.e., the ROI range is ≥2% higher than others, globalization is beneficial for the USA.

Evidently, the assumption of this simulation is not consistent with the fact, i.e., the investment environment in the USA is not better than those in other countries, e.g., the expenses of investments in the USA are much higher than those in many other countries, such as China and India. Otherwise, former President Trump would not worry about globalization. This simulation also informs a fact, i.e., to win in globalization, a country or region needs to provide a better investment environment than the competing ones.

C. Simulation 3 With Taxes Introduced

From the above example and simulation, we conclude that, when the environment for investment is similar among all the countries, globalization is not beneficial for the USA. In this section, we use the standing point of the USA Government and use taxes to conduct governance.

We assume that the capitals pay the USA Government with a tax rate ($t_d^r = 21\%$ [24] to mean the domestic rate in the USA, where t_f^r is the international rate); the USA Government gain is expressed as σ_g^{USAG}, i.e.,

$$\sigma_g^{\mathrm{USAG}} = \sum_{i=0}^{17}\sum_{j=0}^{19} Q[i, j] \times T^*[i, j] \times t_d^r$$

$$+ \sum_{i=0}^{11}\sum_{j=20}^{599} Q[i, j] \times T^*[i, j] \times t_f^r$$

i.e., the USA Government can only collect taxes from the USA-owned capitals that were invested outside the USA. In the simulation, we change t_f^r from 2% to 30% with a step of 2%. We use $\gamma = 54$ to mean more flexibility for the investments.

With this setting, we compare the government gains between globalization and nonglobalization. We need to introduce a new variable $\sigma^{\mathrm{USAG}} = \sigma^{\mathrm{USA}} \times t_d^r$, which means the government gain collected from the capital investing in the USA.

From Simulation 3 (see Table VI), we find that, when the USA Government taxes the investments out of the USA by a rate of more than 20% (The bold rows), globalization is better for the USA Government (the bold data in Table), but not for the USA, because most profits still stay out of the USA.

D. Simulation 4 With Profits Used Back to the USA

In the above simulations, there is an implied assumption that all collected profits stay in the corresponding countries or regions. In this simulation, we assume that there is a rate for the collected profits to be used back to the home countries of the capitals.

TABLE V

SIMULATION 2: BETTER INVESTMENT ENVIRONMENTS (NOI) IN THE USA

USA NOI range	Maximum			Minimum			Average		
	S_g^{USA}	S^*	S^{USA}	S_g^{USA}	S^*	S^{USA}	S_g^{USA}	S^*	S^{USA}
[0.01,0.31]	99.27	125.05	90.28	25.34	123.10	84.47	**63.08**	**124.00**	**87.90**
[0.02, 0.32]	124.60	128.80	93.87	56.85	124.82	85.46	98.20	126.68	91.24
[0.03, 0.33]	132.17	132.17	97.10	72.53	126.75	90.05	115.22	129.93	94.00
[0.04, 0.34]	135.91	135.91	99.09	92.05	130.78	92.54	125.61	133.61	96.81
[0.05, 0.35]	140.25	140.25	102.38	104.35	132.53	96.02	135.25	137.90	100.13
[0.06, 0.36]	144.48	144.48	105.16	114.02	137.35	95.22	140.42	141.88	103.05
[0.07, 0.37]	148.66	148.66	108.21	133.28	141.56	101.58	145.38	145.91	106.07
[0.08, 0.38]	153.25	153.25	111.37	142.19	145.57	105.44	149.89	150.04	109.12
[0.09, 0.39]	157.08	157.08	114.80	137.94	147.34	107.08	153.44	153.76	111.83
[0.10, 0.40]	161.14	161.14	117.39	142.08	153.43	109.90	157.92	158.05	114.82

TABLE VI

SIMULATION 3: TAXES ARE COLLECTED

t_f^r	Maximum		Minimum		Average	
	S_g^{USAG}	S^{USAG}	S_g^{USAG}	S^{USAG}	S_g^{USAG}	S^{USAG}
0.02	9.09	18.01	1.74	16.68	2.48	17.39
0.04	8.44	17.96	3.47	16.68	4.30	17.42
0.06	9.68	17.93	5.20	16.45	5.85	17.40
0.08	10.84	17.87	6.93	16.64	7.58	17.42
0.10	11.71	18.08	8.67	16.70	9.25	17.43
0.12	13.83	17.93	10.40	16.42	10.98	17.39
0.14	15.45	17.94	12.14	16.47	12.59	17.37
0.16	16.80	17.95	13.88	16.61	14.22	17.35
0.18	17.40	17.79	15.61	16.76	15.83	17.40
0.20	**19.76**	**17.93**	**17.35**	**16.02**	**17.63**	**17.34**
0.22	**20.88**	**17.89**	**18.84**	**16.50**	**19.31**	**17.38**
0.24	**22.58**	**17.94**	**20.35**	**16.72**	**21.07**	**17.38**
0.26	**25.12**	**17.84**	**21.51**	**16.68**	**22.69**	**17.42**
0.28	**26.77**	**17.99**	**22.30**	**16.60**	**24.38**	**17.42**
0.30	**28.25**	**17.88**	**24.24**	**16.63**	**25.96**	**17.41**

TABLE VII

SIMULATION 3: THE PROFITS ARE REQUESTED TO BE USED BACK TO THE USA

t_{fb}^r	Maximum		Minimum		Average	
	S_g^{USAG}	S^{USA}	S_g^{USAG}	S^{USAG}	S_g^{USAG}	S^{USAG}
0.20	44.76	85.21	24.05	79.01	27.26	82.75
0.25	45.40	85.35	30.06	79.80	32.79	82.89
0.30	57.52	85.04	36.09	80.02	39.03	83.09
0.35	62.79	85.51	42.11	79.20	44.54	82.85
0.40	60.20	85.26	48.06	78.81	50.23	82.88
0.45	63.74	85.51	54.12	80.07	55.79	83.04
0.50	69.37	85.22	60.16	79.62	61.77	82.99
0.55	75.21	85.52	65.37	79.58	67.59	82.93
0.60	79.27	85.41	69.07	79.10	72.79	82.63
0.65	87.88	85.40	75.75	79.90	79.30	83.02
0.70	89.12	85.38	80.79	79.12	84.61	82.92
0.75	**95.59**	**85.00**	**85.36**	**79.76**	**90.52**	**83.03**
0.80	**105.26**	**85.54**	**86.81**	**79.00**	**96.45**	**82.91**
0.85	**104.92**	**85.22**	**94.77**	**78.55**	**102.14**	**82.97**
0.90	**110.68**	**85.42**	**98.50**	**79.81**	**107.79**	**82.98**

We assume that part of the collected profits will be used back to the USA by a rate (t_{fb}^r). Then, the profits of the USA are expressed as $\sigma_{\text{gb}}^{\text{USA}}$, i.e.,

$$\sigma_{\text{gb}}^{\text{USA}} = \sum_{i=0}^{12}\sum_{j=0}^{19} Q[i,j] \times T^*[i,j] + \sum_{i=12}^{17}\sum_{j=0}^{19} Q[i,j] \times T^*[i,j] \times \left(1 - t_{\text{fb}}^r\right) + \sum_{i=0}^{17}\sum_{j=20}^{599} Q[i,j] \times T^*[i,j] \times t_{\text{fb}}^r$$

which means that those capitals whose home country is not the USA but invests in the USA need to return the t_{fb}^r part of their profits back to their own countries. σ^{USA} keeps the same as that in Simulation 1. We use $\gamma = 54$, the same as that used in Simulation 3.

In the simulation, we change t_{fb}^r from 20% to 90% with a step of 5%. With this setting, we compare the profits between globalization and nonglobalization.

With the simulation results (see Table VII), we find that, if more than 75% (the bold rows) of the profits collected outside of the USA are used back to the USA, then globalization is beneficial to the USA.

V. DISCUSSION

From the simulations described in Section IV, we find that globalization is not beneficial for the USA in the sense of profits obtained by the USA from the investments of giant capitals. This conclusion is confirmed by Simulation 2 if the investment environments of the USA cannot be made better than other countries. Simulation 3 informs that a government may collect more gains from globalization by taxations, which are much less than the whole country's holding of profits. Simulation 4 informs that requiring capitals to use their profits for their home countries is an amendment policy for their home countries. However, this request does not follow the principle of capital, i.e., seeking profits, and the nature of globalization.

The evident reasons are that most giant capitals belong to the USA. We can infer from the simulation results that German, Switzerland, Great Britain, and France should oppose such globalization if their investment environments are not guaranteed better than other countries.

Such a capital holding status presents a fact that the government of any country holding more capitals should oppose globalization, but that of a country holding fewer capitals should support globalization from the perspective of capital investment. Therefore, we may encounter such a dilemma that most WTO members do not hold large capitals and will support the globalization policy, but the few countries holding large capitals oppose this policy. If each member has an equivalent vote for such a policy election, the policy will pass.

Following this clue, former President Trump is for the benefit of the USA to have the USA quit WTO. To continue, it is also for the benefit of the USA to quit other world organizations in similar scenarios.

From the RBC's viewpoint, the phases of collaboration [13] include role negotiation, agent evaluation, role assignment, and role execution. Role negotiation, as the first step of collaboration, can be split further into finer steps, including integration, agent categorization, role awareness, and role specification. Correspondingly, in this article, all the giant capitals are the results of integration, and all the industries of different countries are the result of role awareness and specification. The ROI values in the Q matrix are the result of agent evaluation.

The simulations present that the USA would not like to participate in this collaboration, i.e., globalization, because such a role assignment result is not beneficial for the USA. The simulation process and results again verify the applicability of the RBC theory and E-CARGO model.

In the simulations, we take giant capitals as the key players in globalization. There are still many questions to be answered: What are the real players of globalization? How should these giant capitals be applied to globalization? What are these capitals really meaning for the governments, organizations, or people in the world? Can a government control these giant capitals? Can the capitals control the world?

VI. Related Work

This section is placed here to make readers understand the research path of this article and also mean that the author recognizes the contributions of the peer researchers in globalization. Globalization has pros [25] and cons [7], [26]. Therefore, globalization attracts a variety of researchers to investigate and argue [25]–[39]. Some discuss the impacts of globalization from different perspectives [25]–[37], and some present methods to study globalization [38], [39].

Aide and Grau [27] argue that countries of Latin America are experiencing land-use dynamics as socioeconomic globalization extends its effects. They suggest that the world's resources should be used efficiently to balance the food, health, and educational needs with the need to conserve the world's biodiversity and ecosystem services. They believe that the globalization process neglects many environmental and social issues.

Adesina [28] examines the negative effects of globalization on Nigeria by focusing on its impact on science and technology and the environment. He argues that, although globalization presents many opportunities, it also exposes developing countries, such as Nigeria, to many new challenges. He also suggests ways by which the negative effects of globalization can be addressed.

Bourguignon [25] states that globalization is a positive-sum game but with potentially adverse distributional effects at a national level.

Broitman and Czamanski [29] think that the spatial interactions among cities are significant drivers of their growth. They state that the reallocation of ideas among cities is a source of improved allocation of resources. They believe that the economy is a dynamic, self-organizing system and propose a closed-economy, agent-based model to study their local economy at different levels of globalization. They use the intensity of globalization as a critical economic process that produces differences in convergence and divergence in their economic system. They show that the gross domestic product of their urban system increases greatly with the increase in the globalization level.

Kilic [7] studies the effects of economic, social, and political globalization on the growth levels of developing countries and causality relationship between the variables by using the fixed-effect least-squares method and the Granger causality test for 74 developing countries between 1981 and 2011 period. The analysis results inform that economic growth levels of the selected developing countries were positively affected by economic and political globalization, whereas social globalization affected economic growth negatively.

Kilpatrick [31] reports that many invasive species that have been spread through the globalization of trade and travel are infectious pathogens. It is believed that the impacts of the Western Nile Virus (WNV) on wildlife have been yet more severe than those on humans.

Labonté *et al.* [32] discuss the impacts of globalization on public health. They emphasize that the increased global flows are driving, and driven by, global market integration. They conclude with a call for national governments, especially those of wealthier nations, to take greater account of global health and its social determinants in all their foreign policies.

Rodrik [33], [34] discusses the paradox of globalization and believes that globalization leads to the rise of populism by an empirical analysis of the 2016 presidential election.

Sivapuram and Shaw [35] discuss the phenomenon of globalization of local risks. They present the results from a regional survey conducted on the globalization of local risks through investments in the vulnerable regions of Asia. Their study indicates that countries that have been successful in attracting global investments in manufacturing and service industries are highly vulnerable to natural hazard risks. They conclude that risk communication plays an important role in mitigating the globalization of local risks.

Subramaniam and Masron [36] study the impact of economic globalization on biofuel in developing countries. They point out that globalization has become the most influential aspect of economic growth in developing countries in recent years. As developing countries accelerate the pace of globalization, whether the nature of biofuel production is growing due to ongoing globalization becomes an issue. They examine the impact of globalization on biofuel in panel data of 50 developing countries for the period from 2012 to 2016. Their estimation results show that economic globalization has a positive effect on biofuel production. They suggest encouraging the economic aspect of globalization but reducing the harmful environmental impacts.

Sun and Liang [37] study how globalization can differentially affect financial inclusion through the lens of microfinance. They argue that microfinance institutions (MFIs) express both the social logic and the market logic in consideration of the provision of affordable microfinance loans. They find that country-level social globalization measure is negatively associated with the average MFI loan interest rates and that country-level economic globalization measure has an inverse U-shaped relationship with the average MFI loan interest rates.

Stanojević and Kotlica [38] argue that the usage of the statistical data of the volume of international trade, which has a significant distortion, in quantitative research does not provide reliable information regarding the development potential of a particular export route (orientation) or products. They propose a specific methodological procedure to correct these data, prior to their application in known econometric models. The proposed procedure is applied to the Serbian export groups of products and several of its key export partner countries and obtains convincing results.

Rittenhofer [39] criticizes existing approaches to study small to medium-sized enterprise (SME) globalization. Such methods use an interpretative community that conceives of territorial geography as the nodal point of SMEs and do not distinguish between internationalization and globalization. He addresses related methodological challenges and offers a reflexive method with a goal to increase the productiveness of analytical exploration of the multidimensional quality of SME. He makes a case for SME globalization research to move beyond socialist and individualist ontologies to embrace social-constructionist thinking, make practice the unit of case studies, and appreciate process geographies of managing and organizing.

However, there is little research work related to globalization by computational social simulations. Compared with existing research for globalization, such a simulation approach provides easy-to-understand results and conclusions. We had a successful trial to simulate a phenomenon in social systems in [17] to help an individual acquire a preferred position in a team. The results confirmed several common-sense statements. Our previous work on RBC [10]–[17], E-CARGO [10]–[17], and GRA [12]–[16], [40], [41] provides a solid foundation for the proposed research. Self-citations seem unavoidable.

There are also few trials to simulate social phenomena with integer linear programming (ILP) [42]. We believe that it is E-CARGO and related models that connect social phenomena with ILP.

VII. Conclusion

The contribution of this article is a new way to study globalization from the viewpoint of investment, i.e., using the revised GRA model to simulate possible investment distributions as globalization.

Other interesting findings are given as follows.

1) Globalization (i.e., investment of grand capitals over the world) is not beneficial for the USA. Former President Trump's policy against globalization is in the interest of the USA.
2) To win in globalization, a government needs to improve its country's investment environment, i.e., increase the ROI values of the country.
3) Taxing is an amendment if globalization cannot be avoided and the investment environment cannot be improved from the aspect of the USA Government gain.
4) Requesting capitals to use their profits in their home countries may help the home countries in globalization. However, this request is inconsistent with the principle of "capitals are profit-seeking."
5) One more general conclusion is that former President Trump is for the benefits of the USA by his policies to quit some world organizations, such as WTO.

Future work may include the following.

1) This article implies a computational way to understand globalization. We may collect the real data of ROI in relevant countries and obtain the exact answer of the collected profit.
2) The resources in the world are limited. The distribution of resources is a big challenge to all the countries in the world. We may use E-CRAGO and related models to conduct studies of resource distributions by setting up different conditions. We may draw interesting conclusions that assist policymakers in establishing new international treaties and organizations.
3) We should admit that investment does not create only profits but negative impacts on local environments [37]. Therefore, investment outside the USA also saves the local risks to the environment of the USA, which is a positive impact on the USA. We may also simulate such situations by considering more such factors in the future.
4) Economists may use the way of RGMRA to simulate similar scenarios in the world. Politicians may use the conclusions obtained in this article to argue for policymaking.
5) Agent modeling [43]–[46] is widely used in simulations. It is an interesting topic to analyze and compare the simulation results of the E-CARGO and agent-based approaches.

Appendix A

Globalization With the Assumed Q Matrix

The 18×600 Q matrix could be found in the Supplementary Material, where the top left 12×20 part is used to collect the profits for the USA in nonglobalization.

The compressed T^* matrix and the applied corresponding ROI values are presented as follows.

$$T[0, 547] = 32, \quad Q[0, 547] = 0.30$$
$$T[0, 557] = 22, \quad Q[0, 557] = 0.30$$
$$T[1, 151] = 32, \quad Q[1, 151] = 0.30$$
$$T[1, 358] = 12, \quad Q[1, 358] = 0.30$$

$$T[2, 18] = 32, \quad Q[2, 18] = 0.30$$
$$T[2, 595] = 06, \quad Q[2, 595] = 0.30$$
$$T[3, 211] = 25, \quad Q[3, 211] = 0.30$$
$$T[4, 394] = 24, \quad Q[4, 394] = 0.30$$
$$T[5, 474] = 21, \quad Q[5, 474] = 0.30$$
$$T[6, 16] = 17, \quad Q[6, 16] = 0.30$$
$$T[7, 445] = 14, \quad Q[7, 445] = 0.30$$
$$T[8, 272] = 14, \quad Q[8, 272] = 0.30$$
$$T[9, 345] = 13, \quad Q[9, 345] = 0.30$$
$$T[10, 371] = 13, \quad Q[10, 371] = 0.30$$
$$T[11, 501] = 13, \quad Q[11, 501] = 0.30$$
$$T[12, 489] = 20, \quad Q[12, 489] = 0.30$$
$$T[13, 377] = 28, \quad Q[13, 377] = 0.30$$
$$T[14, 581] = 25, \quad Q[14, 581] = 0.30$$
$$T[15, 581] = 15, \quad Q[15, 581] = 0.30$$
$$T[16, 266] = 13, \quad Q[16, 266] = 0.30$$
$$T[17, 353] = 11, \quad Q[17, 353] = 0.30.$$

The translations of $T*$ are given as follows.

1) BlackRock invests U.S. $3200B on transportation and warehousing in Denmark.
2) BlackRock invests U.S. $2200B on arts, entertainment, and recreation in Denmark.
3) Vanguard Group invests U.S. $3200B on professional in Italy.
4) Vanguard Group invests U.S. $1200B on accommodation and food services in Russia.
5) JP Morgan Chase invests U.S. $3200B on accommodation and food services in the United States.
6) JP Morgan Chase invests U.S. $0600B on educational services in Portugal.
7) Bank of America Merrill Lynch invests U.S. $2500B on professionals in South Korea.
8) State Street Global Advisors invests U.S. $2400B on administrative and support, waste management, and remediation services in Belgium.
9) Fidelity Investments (FMR) invests U.S. $2100B on administrative and support, waste management, and remediation services in Poland.
10) Bank of New York Mellon invests U.S. $1700B on health care and social assistance in the United States.
11) Capital Group invests U.S. $1400B on wholesale trade in Indonesia.
12) Goldman Sachs Group invests U.S. $1400B on scientific and technical services in Switzerland.
13) Prudential Financial invests U.S. $1300B on wholesale trade in Russia.
14) Morgan Stanley & Co. invests U.S. $1300B on professional in Mexico.
15) Allianz SE (PIMCO) invests U.S. $1300B on mining, quarrying, and oil and gas extraction in Singapore.
16) Allianz SE (PIMCO) invests U.S. $2000B on finance and insurance in Saudi Arabia.

0.22	0.12	0.22	0.20	0.04	0.17	0.24	0.29	0.26	0.24	0.24	0.23	0.22	0.28	0.04	0.25	0.09	0.03	0.29	0.03
0.14	0.19	0.16	0.04	0.26	0.05	0.24	0.11	0.29	0.23	0.25	0.08	0.14	0.27	0.26	0.07	0.16	0.19	0.07	0.04
0.23	0.19	0.02	0.15	0.11	0.22	0.23	0.17	0.03	0.04	0.03	0.09	0.27	0.01	0.12	0.13	0.05	0.21	0.20	0.05
0.09	0.06	0.00	0.20	0.19	0.23	0.10	0.13	0.23	0.15	0.12	0.06	0.14	0.18	0.19	0.15	0.23	0.06	0.11	0.14
0.17	0.19	0.26	0.15	0.09	0.21	0.04	0.05	0.07	0.11	0.08	0.16	0.28	0.13	0.25	0.16	0.04	0.27	0.25	0.19
0.12	0.23	0.13	0.26	0.07	0.20	0.06	0.19	0.14	0.15	0.13	0.24	0.29	0.11	0.29	0.15	0.07	0.26	0.04	0.10
0.22	0.02	0.14	0.30	0.01	0.27	0.19	0.28	0.25	0.07	0.01	0.30	0.18	0.29	0.28	0.11	0.11	0.15	0.13	0.09
0.11	0.07	0.28	0.20	0.19	0.11	0.23	0.16	0.15	0.09	0.07	0.11	0.23	0.29	0.17	0.03	0.29	0.14	0.30	0.04
0.18	0.16	0.14	0.22	0.15	0.25	0.22	0.08	0.17	0.06	0.01	0.01	0.01	0.02	0.16	0.03	0.21	0.15	0.25	0.08
0.29	0.04	0.03	0.01	0.03	0.26	0.22	0.10	0.02	0.23	0.29	0.23	0.16	0.15	0.05	0.18	0.18	0.21	0.21	0.14
0.04	0.28	0.21	0.03	0.07	0.15	0.23	0.02	0.25	0.15	0.14	0.06	0.09	0.17	0.24	0.25	0.05	0.11	0.18	0.25
0.28	0.14	0.06	0.22	0.03	0.25	0.22	0.07	0.03	0.27	0.21	0.19	0.24	0.03	0.24	0.04	0.26	0.19	0.22	0.24

Fig. 5. Example of $Q^{USA}(12 \times 20)$, which is a part of the matrix Q.

17) UBS invests U.S. $2800B on arts, entertainment, and recreation in Mexico.
18) Barclays plc invests U.S. $2500B on mining, quarrying, and oil and gas extraction in Portugal.
19) AXA Group invests U.S. $1500B on mining, quarrying, and oil and gas extraction in Portugal.
20) Credit Suisse invests U.S. $1300B on retail trade in Switzerland.
21) Amundi/Credit Agricole invests U.S. $1100B on management of companies and enterprises in Russia.

Appendix B

Nonglobalization With the Assumed Q Matrix

Q^{USA} is presented in Fig. 5.

The compressed T^* matrix and the applied corresponding ROI rates are presented as follows.

$$T[0, 11] = 32, \quad Q[0, 11] = 0.29$$
$$T[0, 19] = 22, \quad Q[0, 19] = 0.29$$
$$T[1, 8] = 12, \quad Q[1, 8] = 0.26$$
$$T[1, 18] = 32, \quad Q[1, 18] = 0.30$$
$$T[2, 13] = 32, \quad Q[2, 13] = 0.30$$
$$T[2, 18] = 06, \quad Q[2, 18] = 0.30$$
$$T[3, 0] = 25, \quad Q[3, 0] = 0.29$$
$$T[4, 13] = 24, \quad Q[4, 13] = 0.29$$
$$T[5, 5] = 21, \quad Q[5, 5] = 0.26$$
$$T[6, 16] = 17, \quad Q[6, 16] = 0.30$$
$$T[7, 5] = 14, \quad Q[7, 5] = 0.30$$
$$T[8, 5] = 14, \quad Q[8, 5] = 0.29$$
$$T[9, 4] = 13, \quad Q[9, 4] = 0.29$$
$$T[10, 14] = 13, \quad Q[10, 14] = 0.29$$
$$T[11, 14] = 13, \quad Q[11, 14] = 0.27.$$

Evidently, all the investments are in the USA, and the profit rates are a little lower than those in globalization presented in Appendix A.

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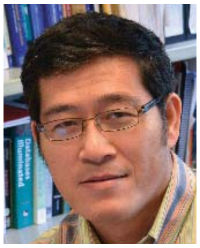

Haibin Zhu (Senior Member, IEEE) received the B.S. degree in computer engineering from the Institute of Engineering and Technology, Zhengzhou, China, in 1983, and the M.S. and Ph.D. degrees in computer science from the National University of Defense Technology (NUDT), Changsha, China, in 1988 and 1997, respectively.

He was a Visiting Professor and a Special Lecturer with the College of Computing Sciences, New Jersey Institute of Technology, Newark, NJ, USA, from 1999 to 2002, and a Lecturer, an Associate Professor, and a Full Professor with NUDT from 1988 to 2000. He is currently a Full Professor and the Chair of the Department of Computer Science and Mathematics, the Founding Director of the Collaborative Systems Laboratory, a member of the Research Committee, Nipissing University, North Bay, ON, Canada. He has accomplished over 200 research works over 100 journal articles, six books, five book chapters, three journal issues, and four conference proceedings. His research interests include collaboration theory, technologies, systems, and applications, human–machine systems, computer-supported cooperative work (CSCW), multiagent systems, software engineering, and distributed intelligent systems.

Dr. Zhu has served as a PC member of more than 100 academic conferences. He was a recipient of the Meritorious Service Award from the IEEE Systems, Man and Cybernetics (SMC) Society in 2018, the Chancellor's Award for Excellence in Research in 2011, two research achievement awards from Nipissing University in 2006 and 2012, the IBM Eclipse Innovation Grant Awards in 2004 and 2005, the Best Paper Award from the 11th ISPE International Conference on Concurrent Engineering (ISPE/CE2004), the Educator's Fellowship of OOPSLA'03, the Second Class National Award for Education Achievement in 1997, and three First Class Ministerial Research Achievement Awards from China in 1997, 1994, and 1991. He has been an Active Organizer of the annual IEEE International Conference on SMC since 2003, the registration co-chair since 2021, the co-chair since 2020, the poster co-chair since 2020, the special session chair since 2019, the tutorial chair since 2018, the area co-chair since 2017, the social media co-chair since 2015, and the web co-chair since 2015 and was the Special Session Organizer from 2003 to 2020. He was the Program Co-Chair of the 13th International Conference on Computer Science and Information Technology in October 2020, Online (ICCSIT2020), and the tenth International Conference on Pervasive and Parallel Computing, Communication, and Sensors in November 2020, Online (PECCS2020), the Publication Chair of the first IEEE International Conference of Human-Machine Systems in September (online), and the Program Chair of the 16th IEEE International Conference on Networking, Sensing and Control, Banff, AB, Canada, in May 2019. He was the PC Chair of the 24th IEEE International Conference on Computer Supported Cooperative Work in Design (CSCWD), Dalian, China, in May 2020, and CSCWD'13, Whistler, BC, Canada. He is also the Founding Researcher of the Role-Based Collaboration and Adaptive Collaboration. He has been serving as Associate Vice President (AVP) of Systems Science and Engineering, the Co-Chair of the Technical Committee of Distributed Intelligent Systems, a member of the SSE Technical Activity Committee, the Conference and Meetings Committee, and the Electronic Communications Subcommittee of the IEEE SMC Society, and an Associate Editor (AE) for IEEE TRANSACTIONS ON SMC: SYSTEMS, IEEE TRANSACTIONS ON COMPUTATIONAL SOCIAL SYSTEMS, *IEEE SMC Magazine,* and *IEEE Canadian Review*. He has offered over 70 invited talks on collaboration internationally, e.g., Canada, the USA, China, the U.K., Germany, Turkey, Hong Kong, Macau, and Singapore. His research has been being sponsored by the Natural Sciences and Engineering Research Council (NSERC), IBM, DRDC, and OPIC.