

ACHIEVING RESOURCE EFFICIENCY BY CUSTOMS ADMINISTRATIONS IN A CONSTRAINED ECONOMIC CLIMATE: A CRITICAL EXAMINATION

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Abstract

Handling Customs' ever-expanding portfolio of goals requires significant expenditure, for example, for trade security programs such as the Customs-Trade Partnership Against Terrorism (C-TPAT). Simultaneously, economic depression jeopardises resource allocation to Customs. Thus, a crucial question is 'How can Customs utilise its limited resources most efficiently to achieve its mandated goals?' This paper addresses this question by examining initiatives requiring Customs to collaborate with external organisations in order to reap resource efficiencies. Among the paper's central contributions are guidelines to maximise and assess the resource efficiency value of these collaborations. The paper draws on theories such as inter-organisational citizenship theory and research methods such as computer simulation.

Introduction

This paper represents one of the outputs from an ongoing three-year research project on inter-organisational relationships within North America's trans-border supply chain environment. The project has a special focus on Canada. The relationships of interest are among the following organisations: (i) companies operating import/export supply chains that traverse Canada's borders, collectively referred to throughout this paper as the trade community, (ii) cross-border trucking firms, (iii) customs brokers, (iv) international freight forwarders, (v) Customs, and (vi) other government departments with regulatory authority in that environment. The overall project looks at these relationships from the standpoint of their engagement processes, enablers, challenges, and effectiveness. The research project's aim is to gain a deeper understanding of how the effectiveness of these relationships might be maximised. For this paper, the effectiveness measure of interest is Customs' resource efficiency in attaining its top priority goal of secure trans-border trade, that is, to minimise the risks of trans-border supply chains being conduits for or targets of harm to national security. The fact that this is a top priority is frequently affirmed in documented statements by Customs heads such as the Canada Borders Service Agency's President Stephen Rigby.²

Since cost containment is a key aspect of resource efficiency, this paper's central focus is on how a Customs agency's relationships with (a) Customs agencies in other countries and (b) the trade community can help to realise this goal at minimum cost. Thus, in pursuing initiatives to achieve this goal, Customs must be mindful of cost considerations. The paper's objective is to provide thorough treatment of four initiatives that involve collaborative working relationships with (a) and (b). The following are the initiatives studied: (1) mutual recognition of trade security programs in other nations, (2) facilitating engagement with the trade community, (3) modelling the cost of security program adoption, and (4)

collaboration to overcome border obstacles to legitimate supply chains – the latter three of which involve a Customs agency’s collaboration with the trade community. The remaining discussion that precedes treatment of these four initiatives is organised into two sections. In order, these are a brief review of the relevant literature and an explanation of the research methods used. Our conclusions and recommendations follow our discussion of the four initiatives.

Background literature

In light of this study’s focus on inter-organisational relationships involving Customs, it draws on theoretical foundations in the scholarly literature on inter-organisational relationship management. Indeed, relationships involving non-commercial organisations (for example, Customs) are not explicitly the purview of the inter-organisational relationship management literature. Yet, despite its commercial slant, that literature has yielded concepts and narratives that can be readily adapted to the kind of inter-organisational relationships covered in this paper. A prime example is the concept of inter-organisational citizenship behaviours (ICB) in the work of Autry, Skinner and Lamb (2008). Their work’s premise is that for organisational success to be attained, the individual’s citizenship role cannot be confined to the organisation that employs him/her but must expand to cover a network of organisations. With that premise, the authors extended citizenship norms for effective organisational performance into citizenship norms for effective inter-organisational (and intra-organisational) performance. An in-depth review of this and other works on inter-organisational relationships is beyond the scope of this paper. The interested reader is referred to Moskalev and Swensen (2007) and Werner (2002) as examples of works containing useful reviews of that literature.

The other scholarly literature in which the present study is rooted comprises studies recognising the impact of Customs on trans-border supply chains. Some of the earlier works include Carr and Crum (1995), Haughton and Desmeules (2001), and Heaver (1992). More recent works from the post-9/11 era include that by Haughton (2007) who developed a model to determine conditions under which companies might see economic wisdom in adopting Customs’ trade security programs. The present study builds on these works by casting more light on the role of Customs as a proactive and dynamic participant in inter-organisational relationships with parties such as members of the trade community. In studying the four initiatives stated in the paper’s introduction, the present study also extends this Journal’s tradition of research that is keenly tuned to Customs’ activities. These include Grainger (2008), Holloway (2009), Jansson (2009), and Lewis (2009).

Research methods

For this paper (and for the three-year project it is a part of), the core data collection falls into the class of unobtrusive methods (sometimes referred to as non-reactive or secondary methods). Detailed exposition on this class of methods can be found in, for example, Berg (2001) and Prior (2003). Applying the methods to the present research involved using publicly accessible documents and notes from meetings/conferences of stakeholders in North America’s trans-border supply chain environment. These activities, which began in May 2008, are summarised in Table 1 below. Archived documents we perused covered the post-9/11 period and comprised over 300 articles written by/for trans-border supply chain practitioners in journals, newsmagazines, newspapers, and newsletters/news-bulletins, over 30 reports from sectoral interest groups and think-tanks, and over 20 substantive reports maintained at the Canada Border Services Agency (CBSA) website. Four conferences and meetings also provided data sources that were either open to public access or to which research data collection access was granted (where appropriate and opportune, we also conducted informal and unstructured interviews of some attendees to gain sharper insights). The most significant of these sources was the Canadian Association of Importers and Exporters (CAIE) 18th Annual Conference (20-22 April 2009) on ‘Emerging issues in Customs and

trade compliance'. The conference produced 12 pages of notes capturing the delegates' and presenters' verbatim and paraphrased dialogue that is keyed to issues of inter-organisational relationships with Customs.

With the bulk of the data from these sources being qualitative, qualitative content analysis was a logical choice for inclusion among our data analysis methods. According to Patton, the method is defined as 'any qualitative data reduction and sense-making effort that takes a volume of qualitative material and attempts to identify core consistencies and meanings' (Patton 2002, p. 453). Details of this method's logic, principles, and processes can be found in, for example, Berg (2001) and Prior (2003), and in cited sources for Hsieh and Shannon (2005). For greater depth and expositional clarity in the research, we complemented the qualitative content analysis with methods of scientific inquiry involving quantitative modelling techniques. One of these involved a queueing simulation (to investigate joint efforts by businesses and Customs to streamline truck queues at customs checkpoints). The other was spreadsheet modelling of formulae developed to provide some measure of quantitative precision for outcomes of various actions by Customs to achieve its security goals. The formulae are presented later in the paper.

Table 1: Structure of data collection

DATA SOURCE AND/OR ORGANISATION	DATA (Publicly available documents, notes from conferences and meetings, interview data)
Canadian Association of Importers and Exporters (CAIE ³)	<i>Tradeweek</i> (fortnightly newsletter); <i>I.E. Global</i> (bi-annual magazine); <i>I.E. Today</i> (daily bulletin); Conferences and seminars/workshops
Canadian Trucking Alliance (CTA) Ontario Trucking Association (OTA)	<i>Supply Chain Focus Quarterly</i> : (OTA's quarterly newsletter); <i>Annual Report</i> of the OTA; OTA Annual Convention; CTA site news items category for border issues; other OTA/CTA web-based documents (news/press releases, etc.)
Canadian Society of Customs Brokers (CSCB) Canadian International Freight Forwarders Association (CIFFA)	<i>Customs Today</i> (CSCB newsletter); <i>CSCB News and Events</i> ; <i>The Forwarder Magazine</i> (published 2-4 times a year); CSCB Annual Fall Conference; CIFFA site news items category for customs issues; other CSCB/CIFFA web-based documents (news/press releases, etc.)
Canadian Manufacturers & Exporters Association (CMEA)	<i>20/20</i> (CMEA magazine published 6 times a year); other CMEA web-based documents (news/press releases, etc.)
Canada Border Services Agency (CBSA)	CBSA web-site links to topics relevant to the study (e.g., the link titled 'Facilitating Trade'); other documents (news/press releases, etc.)
Sectoral Interest Groups (e.g., Canadian and United States [US] Chambers of Commerce)	Advocacy-orientated reports reflecting the perspectives of the trans-border trade sector members these groups represent
Think-Tanks and Research Centres (e.g., Hudson Institute)	Independent and commissioned reports (e.g., a US Customs and Border Protection [CBP]-sponsored report by the University of Virginia Center for Survey Research)
Article databases (e.g., ABI/Inform)	Post-9/11 practitioner articles (e.g., in the <i>Journal of Commerce</i> online and <i>World Trade Magazine</i>) reporting the perspectives of stakeholders in the trans-border trade environment

DATA SOURCE AND/OR ORGANISATION	DATA (Publicly available documents, notes from conferences and meetings, interview data)
The following meetings and conferences in Arizona: Border Trade Alliance (BTA) workshop in Yuma, 19 September 2008; Southern Arizona Logistics Education Organization (SALEO) in Tucson, 24 September 2008; border stakeholders/officials at the Nogales border connecting Sonora (Mexico) and Arizona, 13-14 November 2008	Perspectives on Mexico-to-US trade logistics issues from representatives of the trade sector, truck transportation and logistics sectors, city/state government agencies in Sonora, and US CBP and Department of Homeland Security (DHS)
CAIE 18th Annual Conference on ‘Emerging issues in Customs and Trade Compliance’, 20-22 April 2009	Canadian trans-border trade perspectives from conference speakers and delegates representing importers/exporters, Customs (Canada and US), and firms that deliver professional services in the areas of trans-border supply chains and security

Initiatives in the context of inter-organisational relationships

Initiative 1: Mutual Recognition Arrangements (MRAs)

A multi-country mutual recognition arrangement (MRA) means that Customs in each country accepts the other countries’ trade security standards as consistent with its own trade security standards. An example of this is the US’s acceptance of Canada’s Partners in Protection (PIP) program standards as being consistent with those of the Customs-Trade Partnership Against Terrorism (C-TPAT) program. The core logic of MRAs is well understood and indisputable. Specifically, a company that has had its supply chain security validated (certified) by one country participating in an MRA need not endure separate validations in other participating countries. Thus, within a single validation cycle (for example, every three years), a company’s costs of having its supply chain security undergo on-site validation audits by Customs will be lowered by the existence of MRAs among countries covered by the company’s trans-border operations. For Customs, this yields resource efficiency benefits in that supply chain validation (certification) expenditure (for staff and other resources deployed to validate companies) can be shared among multiple customs agencies. That is, each partner country in the MRA incurs only a fraction of the expenditure. This phenomenon may be modelled as in equation (1) below. In the equation θ_t , which measures validation costs as a multiple of inspection costs, is expressed as a function of the number of MRA partners (n). A value of $\theta = 10$ would mean that customs certification costs are 10 times greater than inspection costs (that is, the costs to inspect an individual shipment). The certification cost multiple that would apply in period t for a given partner country in the absence of an MRA is denoted $\bar{\theta}_t$. Equation (1) mathematically expresses our hypothesis that whenever a country is added to a mutual recognition program, certification cost multiple for each country already in the MRA is reduced by $100 \times (1 - \varpi)\%$ of what it was at the previous addition of a new country ($0 < \varpi < 1$). As an example, a value of $\varpi = 0.95$ would mean a 5% cost *reduction* for each country, even though each country need not have the same absolute value for certification cost (Table 3 presents the definition of each variable, and Figure 1 which will be discussed below also graphically clarifies how equation (1) behaves over time). Note that the actual value of ϖ for a given MRA would have to be estimated based on the particulars of that MRA.

$$\theta = \bar{\theta}_t \varpi^{(n-1)} \quad (1)$$

Despite these benefits, MRAs will incur costs associated with coordination across customs administrations. This can be inferred from the literature on the costs of inter-organisational coordination. For example, Gulati and Singh (1998) see coordination costs as those associated with activities among partners; these range from decomposing tasks among members to communication and joint decision making related to the accomplishment of set objectives. These costs are incurred because of inherent ongoing challenges of executing these activities. Other perspectives on the determinants of coordination costs include the costs of ‘setting up a relationship’ and search costs (Bakos & Brynjolfsson 1997), and structures for communication and authority for performing tasks and technology as a resource used in performing tasks (Kim 2000).

A general insight from the literature is that inter-organisational networks with more partners are more complex and thus costlier to coordinate. Yet, other authors have drawn on concepts such as learning, social trust, and interpersonal synergies to posit that while the marginal costs of coordination increase during the early stages of network (or alliance) formation, eventually, they can decrease as a network evolves over the long term. A detailed discussion appears in Chathoth, Heiman and Ungson (2005) where the central idea is that through experience gained over time, partners learn more about highly beneficial ways to reduce coordination costs, and they strengthen the social trust and interpersonal synergies that not only engender the sharing of cost reduction ideas but also enable partners to collaborate more effectively on reducing costs. A possible mathematical representation of the joint phenomena that coordination cost rises with network size and can fall over time is equation (2) below. The right-hand side of the equation yields average coordination cost per certified company per customs agency as a multiple of inspection cost. Note that inspection cost, unlike certification cost, is incurred by Customs at the border to perform inspections of individual shipments. The term ν gauges how fast the coordination cost increases with the number of countries (n), t is the number of periods (years) since the first certification and $\bar{\phi}$ is a non-negative constant to be empirically determined for the country under consideration. Equation (3) shows the aggregate of certification and coordination costs.

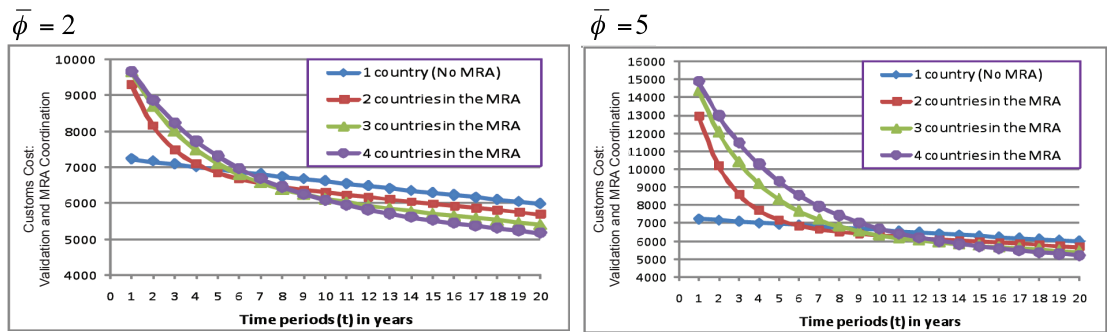
It should be noted that equation (2) is not the only way to mathematically express the ideas that coordination costs increase with the number of MRA partner countries and can decrease over time. Alternative expressions (full discussion of which is beyond the scope of this paper) can be developed for a given MRA to fit that MRA’s data on number of partners, how long the MRA has existed, and on its coordination costs. Given the availability of equally valid alternative mathematical expressions, equation (2) is only meant to be illustrative of the above ideas and should not be interpreted as the definitive mathematical expression of how n and t affect coordination costs. By extension, equation (3) is also meant to be illustrative. Ultimately, the outcome of importance is that the expression used by a particular MRA depicts a progressively beneficial relationship among the MRA partners. Figure 1 graphically depicts that outcome. The graphs in Figure 1 use the illustrative expression in (3) to demonstrate the general trajectory of costs over time for up to four partner countries (n) using the following arbitrarily chosen values:

$$\bar{\phi} = 2 \text{ and } 5; \nu = 0.5; \bar{\theta}_1 = 10; \bar{\theta}_t = 0.99\bar{\theta}_{t-1}; \omega = 0.95.$$

$$\text{Coordination cost as a multiple of inspection cost} = \phi = \bar{\phi} \left(\frac{n-1}{n-\nu} \right)^t; 0 \leq \nu < 1 \quad (2)$$

$$\text{Certification and coordination cost (multiple of inspection cost)} = \theta + \phi = \bar{\theta}_t \omega^{n-1} + \bar{\phi} \left(\frac{n-1}{n-\nu} \right)^t \quad (3)$$

Figure 1: Possible time series of customs certification and MRA coordination costs



The obvious implication from the preceding discussion is that if MRAs are to be sources of resource efficiency for Customs then emphasis must be placed on two key items: (a) continuous learning about supply chain security validation from past experience and from MRA partners and (b) strengthening social trust and interpersonal synergies among partners. That is, these items contribute to a key metric of MRA success: cost-effective attainment of national security priorities. Without doubt, these items are acknowledged as important in the trade security discourse we studied. For example, notions of social trust and interpersonal synergies were emphasised in a joint presentation by senior Canadian and US Customs officials during the aforementioned CAIE conference. The following paraphrased quote from the presentation illustrates: ‘*He is not just my professional counterpart but also a friend; he is a straight shooter so I take him at his word when he makes commitments*’. Given the scholarly literature’s reasoning that strong interpersonal relationships across organisational boundaries are essential for strong inter-organisational relationships or partnerships (see, for example, Fawcett, Ellram & Ogden 2007; Handfield & Nichols, Jr 2002), this quote suggests a solid foundation for the Canada-US MRA. Viewed also through the lens of the inter-organisational citizenship behaviour (ICB) model of Autry, Skinner and Lamb (2008), the Canada-US MRA appears to capture essential behaviours of a structurally sound relationship. These include *altruism* (behaviour directed at helping a partner solve problems or acquire needed skills and knowledge, *constructiveness* (interest and activity in inter-organisational affairs affecting the relationship), and *advancement* (taking steps to improve relationships, knowledge bases, and integrated processes).

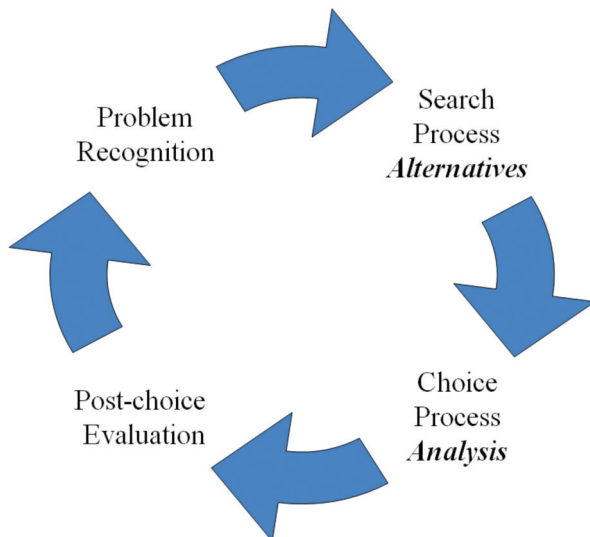
However, in order for the Canada-US MRA to be held up as a benchmark, the relationship’s foundation and behaviours must translate into a particular metric of success: cost efficient use of resources to attain or surpass security goals. Without mechanisms to facilitate the recording, tracking, and analysis of the metric, there will always be doubt about whether success is being realised. That is, MRA partners must operate with knowledge or reasonable prediction of the cost trajectory. Thus, via equation (3), one of our contributions is to propose a model for engendering objective depiction of costs in MRAs. A companion contribution of the model is to help draw attention to the primary cost drivers in an MRA, that is, the costs of performing security assessments and coordinating the MRA are driven by how well the MRA partnership is being managed to facilitate continuous learning/improvement and interpersonal synergies. Such attention can serve as a basis for deep, focused, and *objective* discussion among MRA partners about specific cost containment initiatives that are consistent with security priorities.

Coverage of potential cost containment initiatives is beyond the scope of this paper but we can suggest a conceptual model to guide the choice of initiatives as well as insights for ensuring objectivity and economic rationality in discussions about initiatives. The suggested model is the generic four-phase managerial decision cycle due to Herbert A Simon,⁴ one of the foremost thinkers on decision science (see

Figure 2 below). The outcome from the phase involving search processes would be potentially promising alternatives (in the context of MRAs, sources of ideas for these may range from the extant literature on exemplary inter-organisational relationships to more direct sources such as a nation's own experiences with joint multi-national government undertakings). As well as consistency with security priorities, a key guideline to ensure that rational ideas emerge is that the cost implications of the ideas must not be overlooked. The next phase, which involves more rigorous appraisal of the proposed alternatives, must be grounded in analytical precision about how each initiative might impact cost parameters. As shown in equation (3) these parameters include ϖ (previously defined in discussing equation (1), can be viewed as capturing the learning rate as countries are added to an MRA) and $\bar{\theta}_i$ (also previously defined, can be viewed as depicting an individual customs agency's rate of learning about how to reduce the agency's certification costs). Using an analytical framework such as equation (3), the questions that MRA partners should address in order to remain focused on how cost-effectively an initiative meets or exceeds security priorities include:

1. When we add countries to an MRA, how can we accelerate the learning rate, that is, reduce ϖ , in order to help reduce security assessment costs?
2. Over time, how can we as an independent customs agency accelerate our internal learning rate, that is, reduce $\bar{\theta}_i$, in order to help reduce security assessment costs?
3. How should we structure the business interaction among MRA partners in order to reduce coordination costs, that is, reduce the parenthetical expression in equation (3)?

Figure 2: The perpetual cycle of managerial decision making



Source: Herbert A Simon 1976, *Administrative behavior*, Free Press, New York.

Initiative 2: Facilitating engagement with the trade community

Our research on the Canadian trans-border supply chain context yields incontrovertible evidence of robust engagement between Customs and the trade community. In particular, it appears that both trade community and Customs provide formal institutional frameworks for facilitating the engagement. On the Customs side in Canada, for example, we found that in addition to the more prominent and high-level frameworks such as the Security and Prosperity Partnership (SPP) of North America, there are formal mechanisms for engagement at the more operational level. Primary among these seem to be the Border

Commercial Consultative Committee (BCCC) and the eManifest Stakeholder Partnership Network. On the trade community's side, the formal mechanisms are best exemplified by the CAIE. Specifically, the CAIE operates two committees to formally liaise with Customs: the Customs Legislative and Trade Security committees. Beyond these committees, there are several formal and semi-formal engagement modalities to further enrich the engagement between Customs and the trade community.

A case in point is that CAIE publications such as *Tradeweek* (fortnightly newsletter) and *I.E. Global* (bi-annual magazine) frequently contain articles authored by Customs officials from, for example, the CBSA, US CBP, and the World Customs Organization (WCO). In addition to communicating updates on customs visions, plans, and programs, these articles serve the important function of reiterating customs agencies' earnest pleas for input on future customs trade and security initiatives. Aside from the conventional engagement forums such as town hall meetings, other important media for engagement comprise conferences and workshops hosted by groups with commercial interests in trans-border supply chains. At these conferences/workshops by groups such as Canada's CAIE and Supply Chain Logistics Canada and the US's BTA (representing businesses operating at US/Mexico borders such as Arizona/Sonora), dialogue between Customs and the trade community is a key characteristic. Perhaps most significant among these media in Canada is the CAIE annual conference on 'Emerging issues in Customs and Trade Compliance'. As a matter of course, the conference features keynote addresses and session presentations by customs officials, thus giving delegates from the trade community another set of opportunities to engage with Customs.

Despite the existence and use of these and a host of other means of engagement (for example, firms inviting customs officials to visit their facilities), we do not declare that the relationship between Customs and the trade community is frictionless. The fact is that while the trade community has had reason to commend the government for progress on certain aspects of trade security, it continues to identify limitations and remains a vocal critic of Customs. Table 2 below illustrates this with a sample of trade publication headlines representing voices within the trade community. Indeed, the qualitative data gleaned from the aforementioned CAIE conference and from an online survey we conducted, reinforce what the archival research suggests is a widely held belief that Customs has not progressed sufficiently far or fast in dealing with the trade community's concerns (the targeted respondents were the community's traders, customs brokers, freight forwarders, and trans-border carriers). The reinforcing evidence is based on responses from a convenience sample of the targeted population to the specific question of '*how satisfied are you with the efforts of Customs in facilitating your company's success in trans-border operations?*' On a 7-point Likert scale (with higher numbers corresponding to greater levels of satisfaction), respondents rated the CBSA at 5.00 and the US CBP at 4.71.⁵ These were low in relation to how they rated the efforts of other external groups such as brokers, forwarders, and supply chain partners. Our inference from the plethora of explanations contained in the qualitative data is that they are all variations of the trade community's mantra that 'security trumps trade'.⁶ Though it can be debated whether this mantra is the reality of trade security programs or merely the trans-border trade community's jaundiced view of those programs, one thing is certain: the trade community has not signed on to these programs to the extent that Customs would like. For example, in October 2006 less than 2% of importers involved in significant cross-border movement of goods into Canada adopted the PIP program⁷ and the current penetration rate is estimated at a mere 7% of Canadian companies.⁸

Table 2: Articles citing trade community's concerns about Customs/Canada-US borders

1. **'Canadian border crossings: from bad to worse?'**, *Land Line* article posted at I.E. Canada website, 17 April 2009.
2. **'Border U.S. regulatory barriers mean increased costs for Canadian industry and its customers'**, *NB Business Journal* article posted at I.E. Canada website, 15 April 2009.
3. **'Stuck at the border'**, (*National Post* article posted at I.E. Canada website, 6 April 2009).
4. **'Overlapping security hurting truckers at U.S. border, Canadian officials say'**, *Transport Topics*, 3 March 2008, no. 3782, p. 6.
5. **'Border bottlenecks, regulations top concerns for Ontario shippers, carriers'**, *Transport Topics*, 5 November 2007, no. 3766, pp. 1, 10.
6. **'We need harmony in U.S. border security'**, *The Ottawa Citizen*, 23 May 2007, p. A15.
7. **'Panel: U.S.-Canada trade profitable, but difficult'**, *Transport Topics*, 16 April 2007, no. 3737, p. 43.
8. **'Smart border vision blurred'**, *Truck News*, March 2007, vol. 27, no. 3, p. 44.
9. **'FAST needs to become more transparent'**, *Truck News*, February 2007, vol. 27, no. 2, p. 70.
10. **'Border security is border absurdity'**, *Truck News*, October 2006, vol. 26, no. 10, p. 36.
11. **'Border boondoggle'**, *Truck News*, November 2006, vol. 26, no. 11, p. A20.
12. **'Security bottlenecks snarl U.S.-Canada trade'**, *Reuters*, 5 March 2007.

The commercial sector's low adoption rates of trade security programs represent a curious state of affairs for economically efficient attainment of Customs' security priorities. On the one hand, higher penetration rates will directly enable realisation of not only those priorities but also, in all likelihood, of efficiencies in Customs' border operations. Sources of efficiencies include less effort to conduct secondary inspection of traders who are certified under programs such as C-TPAT and PIP. But high penetration rates require commercial stakeholders in the trans-border trade community to be convinced that they will also gain profit-enhancing efficiencies from certification. This raises the question of what is required to get beyond the current low penetration rates. Indeed, Customs and affiliated agencies have poured much effort into addressing this matter by extolling the business benefits of program adoption. This is exemplified by a DHS-sponsored report⁹ and presentations by customs officials at the recent CAIE conference citing benefits such as fewer and faster inspections. Yet, it is clear that, despite some success from these efforts, one source of opposition (which seems inextricably tied to the mantra of 'security trumps trade') remains persistent: the perception that Customs is yet to truly understand the business realities of trans-border supply chain operations. This perception might have some evidentiary basis because, for example, the 56-page CBP-sponsored/authored report to provide traders with guidelines for best supply chain security practices contains just two brief allusions to the cost of security practices.¹⁰

To provide a conceptual basis for our suggestion that limited focus on cost might not be helpful in realising security goals, we illustrate the suggestion with an abstract model of economic equilibrium for security. The model, which draws on the work of Prentice and Hickson (2007), is in Figure 3. The model depicts the interaction of security benefits (for both the private sector and the public sector; that is, the larger society) and security costs. Benefits for the private sector include protection of private assets associated with trans-border supply chain operations (for example, handling and transport equipment). The larger society's benefits, which can be a positive externality of the private sector's security investment, include safety of citizens.¹¹ For simplicity in presenting the model, the marginal cost of increased security is

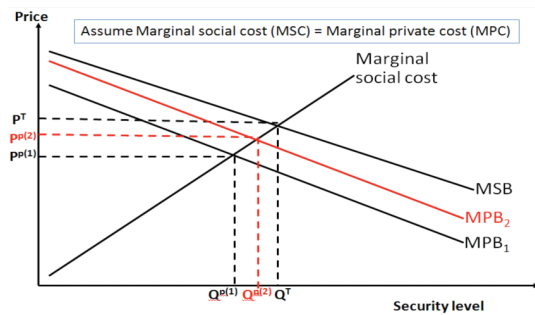
assumed to be the same whether the spending is by the private sector or the public sector; thus, marginal private cost (MPC) = marginal social cost (MSC).

The left panel of the figure shows that efforts by Customs to convince the trade community that the benefits are greater than perceived will shift the curve for marginal private costs upward. A shift from MPB_1 to MPB_2 raises the level of security that the private sector would be willing to spend on (from $Q^{p(1)}$ to $Q^{p(2)}$) and the total private sector expenditure on security (from $P^{p(1)} \times Q^{p(1)}$ to $P^{p(2)} \times Q^{p(2)}$). However, such efforts cannot be regarded as truly beneficial if they merely result in increasing the private sector's share of security without increasing the total level of security, Q^T . What might be a far more certain way to increase the total security level is to discover ways of reducing security costs. The right panel of Figure 3 shows the theoretically expected impact of reducing costs, that is, shifting the MSC curve downward. A shift from MSC_1 to MSC_2 raises the equilibrium level of total security from $Q^{T(1)}$ to $Q^{T(2)}$.

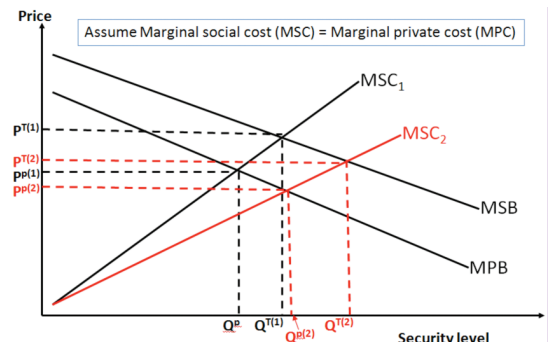
Based on all of this, a logical deduction from the conceptual model in Figure 3 is that efforts to promote security program benefits to the trade community, though valid, must be complemented by a persistent search for ways to minimise cost. In engaging with each other on cost-reduction efforts, Customs and the trade community should be prepared to have frank discussions about a host of issues that might arise. Among these issues are (a) possible incentives (for example, subsidies) for the trade community to bridge the gap between private and total expenditure on security, and (b) identifying which aspect of security would be more economically undertaken by Customs and vis-à-vis the private sector.

Figure 3: The impacts of different courses of action by Customs regarding security

Impact of effectively marketing the supply chain security benefits to the trade community



Impact of working with the trade community to reduce the cost of supply chain security



Initiative 3: Modelling the cost of security program adoption

Based on the preceding discussions of Initiative 2 concerning the need to complement program promotion efforts with a focus on cost minimisation, it follows that the dialogue between Customs and the trade community must evince clear and mutual understanding of the relevant cost implications of program adoption for **both** Customs and the trade community. As such, we propose a set of mathematical models to help visualise these implications and their determinants. Without the logical and objective thinking that is stimulated by visualisation, the dialogue risks descending into platitudinous and subjective assertions that merely pit a customs agency's capability to argue for program adoption against trade community members' capability to assert the financial burden of program adoption. This general notion is rooted in the supply chain management literature on inter-organisational partnerships. That is, a frank, transparent and objective conversation of how a course of action might affect each supply chain partner is an essential basis for a mutually beneficial partnership. The ensuing discussion illustrates this by

clarifying the development of the cost models and, by drawing on known and reasonable estimates of the model's parameters, demonstrating the kind of analysis they can be used for in the Customs-trade engagement.

A natural starting point for the modelling is the fundamental question of why a company operating trans-border supply chains should become validated/certified under trade security programs such as PIP and C-TPAT/FAST (Free and Secure Trade)? The obvious answer from the economic theory of the firm is that the company should do so if becoming certified is more profitable than not being validated. More formally, consider a company that operates in a trans-border setting that is governed by the parameters in Table 3 below (parameter estimates and their sources are also shown). Based on these parameters, a trader opting out of validation would have an annual total cost of customs inspection equal to:

$$\delta_i c q_i \beta \quad (4)$$

A trader that chooses to become certified would have a total cost (comprising inspection cost and certification cost) of:

$$\delta_i c q_i \alpha + \frac{\varepsilon_i \theta c}{3} \quad (5)$$

Since a rational un-validated trader will be expected to choose between remaining un-certified and becoming certified based on the cost comparison of (4) and (5), the conditions under which certification makes sense for the trader can be expressed as:

$$\delta_i c q_i \alpha + \frac{\varepsilon_i \theta c}{3} < \delta_i c q_i \beta; \text{ i.e., } \frac{\varepsilon_i \theta}{3} < \delta_i q_i (\beta - \alpha) \text{ OR } q_i > \frac{\varepsilon_i \theta}{3 \delta_i (\beta - \alpha)} \quad (6)$$

There is no guarantee that this condition will be met for every trader (for example, those with low volumes of trans-border commerce). This assertion from the inequality in (6) is supported by surveys suggesting that traders with small volumes of trans-border trade tend to see certification in trade security programs as an economically inferior option.¹² Therefore, what seems to be Customs' ultimate goal of 100% trader participation in security programs is unlikely to be met. From the standpoint of pursuing this goal, there are several broad initiatives for Customs to help make the inequality easier to satisfy, that is, by reducing the right-hand side of the inequality in (6). For example, through certification audits that expose Customs to innovative supply chain security practices of firms, personnel conducting these audits should also have a keen eye on which practices are most cost-effective. This would help to reduce the right-hand side of the inequality by reducing the firms' cost to become certified and undergo certification audits ($\varepsilon_i \theta$) and by reducing its rate of secondary inspection (α). As implied earlier in this paper, the issue of cost-effectiveness should be more prominent in subsequent catalogues on best practices. An excellent guide for doing so is the work by Gutiérrez et al. (2007).

Table 3: Some key factors influencing the cost of operations for Customs and for trans-border supply chains

Variable/factor	Symbol/notation	Estimate	Estimate source or explanation
Unit cost to Customs for a secondary inspection	c	\$1	Normalised to unity
Proportion of traffic that is certified under Customs-trade security programs	p	0.14-0.27	Formula CAIE Conference
Proportion of traders that are certified/validated (assumption that high volume traders tend be certified earlier than low volume traders)	p^2	0.07	Field notes on PIP
Number of importers	N	31343	CAIE Conference
Mean volume of traffic (trips) per year per trader	q	28	CAIE Conference
Rate of inspection of certified truck traffic	α	1/6	CAIE Conference
Rate of inspection of uncertified truck traffic	β	1/2	Conference
Certification cost as a multiple of secondary inspection cost in time period t ($\bar{\theta}_t = 2, 4, 8, 10$)	$\bar{\theta}_t$	$0.99\bar{\theta}_{t-1}$	Estimated for illustration
Number of countries in the MRA the customs agency participates in	n	3	Estimated for illustration
Whenever a country joins an MRA, the certification cost multiple for each country already in the MRA becomes 100 ω % of what it was at the previous addition of a new country	ω	0.95	Estimated for illustration
A parameter ($0 < v < 1$) to gauge the rate of increase in coordination costs as new countries are added to an MRA	v	0.5	Estimated for illustration
A parameter to indicate the size of coordination cost relative to inspection cost	ϕ	5	Estimated for illustration
Number of countries in the MRA the customs agency participates in	n	3	Estimated for illustration
Unit cost to the i^{th} trader for a secondary inspection	$\delta_i c$	None	
Volume of traffic (trips) for per year for the i^{th} trader	q_i	None	
Unit cost of triennial supply chain security validation (certification) audit for the i^{th} trader	$\varepsilon_i \theta c$	None	

Considering the Customs’ cost along with traders’ cost highlights that apprising traders of cost-effective best practices must be among a customs agency’s essential knowledge sharing and engagement strategies. The formula in (7) depicts a customs agency cost. As with the traders’ cost model, the formula is based on the information in Table 3. The formula shows Customs’ total cost as the sum of costs to conduct inspections at the border ($cqN(p\alpha + (1 - p)\beta)q$), costs to conduct supply chain security validation/certification audits (the formula’s second compound term), and costs to coordinate activities among MRA partners (the last compound term).

$$\begin{aligned}
& cqN(p\alpha + (1-p)\beta) + cNp^2\left(\frac{\bar{\theta}_t\varpi^{n-1}}{3}\right) + \bar{\phi}cNp^2\left(\frac{n-1}{n-v}\right)^t \\
& = cN\left((p\alpha + (1-p)\beta)q + p^2\left(\frac{\bar{\theta}_t\varpi^{n-1}}{3}\right) + p^2\bar{\phi}\left(\frac{n-1}{n-v}\right)^t\right) \quad (7)
\end{aligned}$$

The formula's graphical depiction of how total cost behaves with increases in the proportion of traders whose trans-border supply chains are certified under governments' security programs (p^2) for different values of certification cost as a multiple of shipment inspection cost ($\bar{\theta}_1 = 2, 4, 8, 10$) is in Figure 4 below. The graph assumes that the progress of p^2 from its current level of approximately 0.07 towards $p^2 = 1$ occurs uniformly over a four-year period (that is, $t = 1, 2, 3, 4$). The graph highlights that as p^2 increases, total cost falls then eventually increases and that the point at which the cost increases begin depends on $\bar{\theta}_1$. For example, when that parameter is equal to 2, customs costs of running the validation regime exceed the costs for border inspections when approximately 60% of the traders are certified. The corresponding turning point is 40% when the parameter is equal to 10. True, there is little doubt that higher values of p^2 are likely to enhance security so it is worthwhile to pursue higher values. Nonetheless, the core message to be taken from the graphical analysis cannot be overlooked. It is that if Customs is to be cost-effective in its efforts to increase the percentage of traders that are certified, the cost to audit and certify the security of traders' supply chains must be a prime target for efforts to contain cost.

A related message is that Customs is more likely to succeed in those efforts when it has the trade community's support, for example, promptly providing information that Customs requires for certification audits. This underscores the importance of mutual dependency in achieving cost efficiency for all parties. A company's efforts to make the audit process more efficient for Customs can also enhance that company's efficiency, for example, its personnel might not have to be taken away from their normal job functions for long periods in order to be involved in the audit. Customs, in its best practices catalogue, should document the cases of audit efficiency as benchmarks. For companies that are yet to be validated, these cases affirm that the validation process can be cost-effective and thus help to overcome one source of potential resistance to certification. The process by which both Customs and companies benefit from these two inter-organisational citizenship acts (companies facilitating the audit and Customs disseminating cost-effective best practices) are summarised in Table 4 below.

Figure 4: Impact of certification/validation levels on customs cost

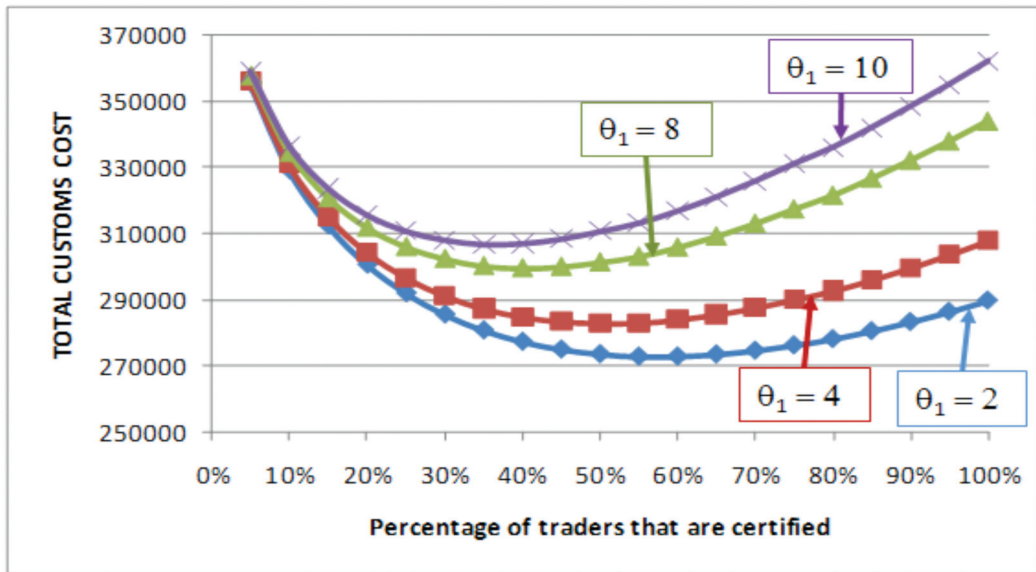


Table 4: Processes of benefits from Customs-Trade inter-organisational citizenship

ACTS OF INTER-ORGANISATIONAL CITIZENSHIP		
OUTCOMES	Company	Customs
Reduction in the company's certification cost ($\epsilon i \theta c$)	Efficiently facilitate Customs personnel performing validation (certification) audits	Disseminate companies' cost-effective best practices for both validation audits and supply chain security
Reduction in Customs, cost to validate/certify companies (θc)	More efficient facilitation can automatically translate to more efficiency for the company itself	Efficient facilitation practices can be adopted by certified companies for future audits and by other companies for the first audit
Larger proportion of firms becoming certified (p^2)	Customs benefits directly from more efficient facilitation by company	Successfully encouraging un-certified companies to become certified will raise a customs agency's experiential learning and competence in doing cost-effective audits
	Provides solid empirical data for Customs to use in encouraging un-certified companies to seek certification	

Initiative 4: Collaboration to overcome border obstacles to legitimate supply chains

Particularly since the tragic events of 9/11, the discourse among stakeholders has unearthed a wide range of suggestions to overcome unnecessary obstacles to legitimate trans-border supply chains. The suggestions are covered in reports by stakeholder groups such as the Ontario Chamber of Commerce¹³ and the Conference Board of Canada¹⁴ as well as in a variety of other articles in sources such as news magazines. The suggestions include actions under the control of border authorities (for example, processing rules such as differential treatment of shipments based on type such as FAST versus non-FAST) and under the control of companies that cross the border (for example, inventory stockpiling, reconfiguring trans-border supply chain networks, and dynamically modifying the routing and scheduling of trans-border shipments). To complement suggestions in the practitioner discourse, we have proposed additional ones based on concepts from inventory management and queueing (waiting line) theories. To carefully evaluate the efficacy of the suggestions, we used the Arena software to build and to continue refining a suite of computer simulation models to capture the essential operating realities of North American border crossings. Of immediate interest to the present research are suggestions that depend on meaningful inter-organisational cooperation.

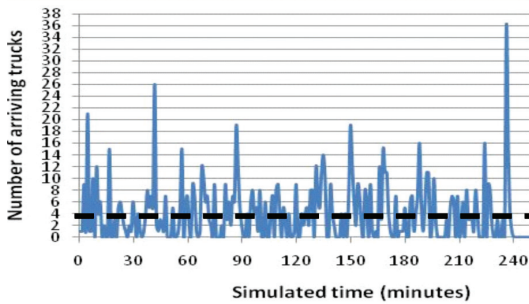
The suggestion we focus on here is based on a notion that is rooted in the academic literature on managing queue operations. It is to smooth the flow of commercial traffic through border crossings by means of what is essentially an appointment system. This traffic smoothing suggestion requires inter-organisational cooperation for at least two reasons. First, setting each truck's (appointed) time of arrival to the border requires cooperation between Customs and trans-border trucking companies and/or among trans-border trucking companies (for example, negotiation to avoid consistently disadvantaging any firm with inconvenient appointments). Second, as in a doctor's office where doctors and other employees have a tacit agreement to be available to process patients at the time of their appointment, Customs would be expected to provide timely processing to each truck that complies with the appointment system. That is, two necessary conditions for the system to be effective are (a) Customs cooperates by fulfilling its implicit obligation to minimise (within reason) deviations from the planned processing times and (b) trucking firms cooperate by arriving at their appointed times (again within reason).

Figure 5 below depicts the kind of behaviour change that is required for an appointment system to work. Part A of the figure is for the arrival patterns (both based on an average of 3.91 trucks arriving per minute). One pattern is unstable: having coefficient of variation for time between truck arrivals equal to 2.8 (that is, the type of pattern that might result without an appointment system). The horizontal dotted line is one example of transitioning to an appointment system. Part B depicts a corresponding transition for Customs: reducing the coefficient of variation of processing times from 1 to 0.33 (dotted line in the graph) without changing mean processing time (equal to 1 minute). We present findings on the expected effects of these behavioural changes using a computer simulation model of operations at the Detroit-Windsor border. In using a truck appointment system as the focal initiative, our purpose is to realise two research objectives concerning this paper's core theme of resource efficiency in accomplishing Customs' priorities. One is to demonstrate the role of computer simulation as a tool to examine the operational-level implications of any specified initiative in terms of its potential impacts on Customs' resource efficiency. The second objective is to present insights on the issues and the types of simulation analyses that are almost certainly relevant to any initiative that depends on significant inter-organisational relationships between Customs and other parties.

Figure 5: Examples of behavioural changes required for effective truck appointment systems

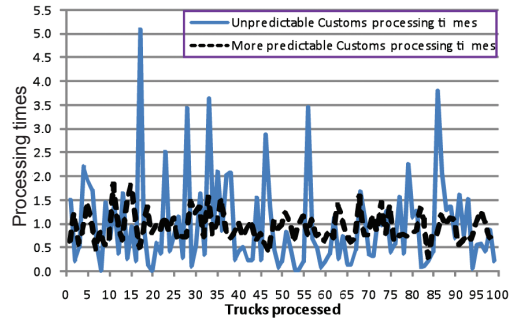
Part A:

Trucking companies' transition from random arrival pattern to stabilised arrival pattern



Part B:

Transition from unpredictable to more predictable processing times by Customs



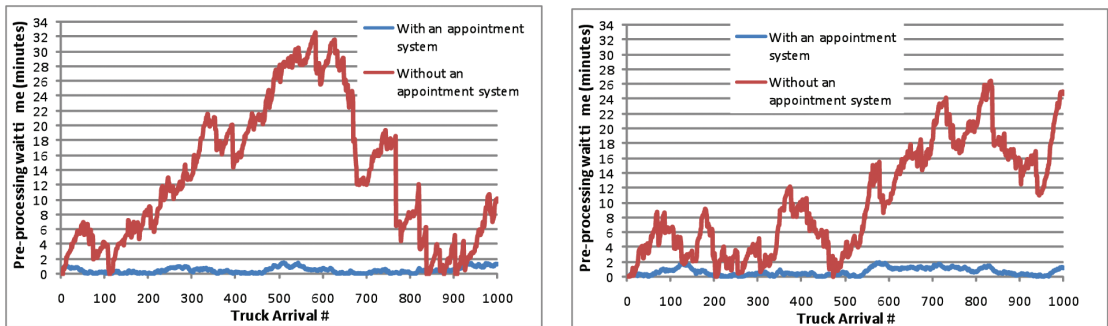
For expositional simplicity and without loss of generality, we limit the results presented herein to primary inspection at Detroit-Windsor and ignore shipment distinctions such as FAST versus non-FAST (a separate research paper is required to properly cover such details in our simulation work, which covers truck processing operations from a truck’s arrival through to its exit from secondary inspection). Table 5 below compares the results for the scenario of no appointment system (coefficient of variation equals 1 for processing times and 2.83 for time between truck arrivals) with the results for an appointment system (coefficient of variation equals 0.33 for processing times and 0 for time between truck arrivals). The table shows the improvements with respect to relevant metrics for both trucking companies and Customs: waiting time, congestion, and processing resources (primary inspection booths). Figure 6 graphs the improvements with respect to the level and uncertainty of waiting time for two of the simulated days in the experiments. The graphs show that without an appointment system, wait times are not only long but also highly unpredictable. With the introduction of an appointment system, the wait times are much smaller as they stay within a narrow band that rarely exceeds one minute.

It should be noted that the inter-organisational citizenship behaviour necessary for reaping these efficiency gains goes beyond each party’s independent action to make transitions such as those in Figure 5. For example, while Customs can attain service time consistency through approaches such as providing front-line officers with training and technology, trucking companies also play an important role in service time consistency. That role covers basic things such as having the proper documentation available upon arrival at the border crossing. Naturally, Customs would be expected to reciprocate (that is, facilitate the required behavioural changes among truckers). After all, as alluded to throughout this paper, for Customs to optimise gains in efficiency gains, selfishly forcing changes on the trade community is unlikely to be helpful. What seems more helpful is to be a true inter-organisational citizen in its engagement with the trade community.

Table 5: Efficiency improvement benefits of an appointment system

	QUANTITATIVE IMPROVEMENTS	CONCLUSION: APPOINTMENT SYSTEM BENEFITS
Average time a truck waits before being processed	Reduced from 9.74 minutes to 0.53 minutes	Less time wasted at the border
Upper limit of 95% confidence interval for waiting time	Reduced from 18.63 minutes to 0.94 minutes	Significantly less uncertainty in freight delivery planning
Average number of trucks waiting to be processed at any given time	Reduced from 38 trucks to 2 trucks	Significantly less truck congestion at the border crossing
Number of primary customs officers required to limit the average wait time to 0.53 minutes (i.e., average time attainable with an appointment system)	Reduced from 8 booths to 4 booths	Significantly less border resources required to process trucks

Figure 6: Impact of an appointment system on wait times for two simulated days



Conclusions and recommendations

Customs work has witnessed an evolution from the primacy of duty collection as a primary goal through to today’s expanded portfolio of goals in which security and trade facilitation are top priorities. This requires significant expenditure on manpower and technology for programs and initiatives to support those goals. Simultaneously, the currently depressed economic climate jeopardises resource allocation to Customs. This behoves Customs to be relentless in seeking ways to accomplish these goals at minimum cost. This paper represents an effort to explicitly bring cost considerations to the forefront of discussions about initiatives to accomplish the goals of Customs. In particular, the paper systematically examines four initiatives that require a nation’s customs agency to develop and maintain productive working relationships with two external parties: customs agencies in other countries and the trade community. The initiatives examined are: (1) mutual recognition of trade security programs in other nations, (2) facilitating engagement with the trade community, (3) modelling the cost of security program adoption, and (4) collaboration to overcome border obstacles to legitimate supply chains.

Embedded in our examination of these issues are three key recommendations. The first is in regard to mathematical models we presented to illustrate a cost-focused approach to analysing initiatives. We recommend the building of similar models that accurately portray the realities of a given trans-border context. The real value of such models rests in their ability to help bring clarity to how costs might behave in response to a given course of action, and to foster logical and objective appraisal of the efficacy of contemplated actions. Our second recommendation concerns the content of the engagement between Customs and the trade community. Although our qualitative research data evince a vibrant engagement that is well supported by both formal institutional process (for example, Canada's BCCC) and less formal means (for example, networking at CAIE conferences/meetings), we found no clear evidence of a focus on cost minimisation in pursuing security priorities. In fact, our reading of the data is that much of the dialogue between the two parties features a strong emphasis on urging the trade community members to become certified under trade security programs.

While it is risky to definitively conclude that this emphasis overwhelms the cost focus, we do underline that the dialogue must demonstrate cognisance of cost issues. More specifically, through means such as sharing its knowledge of cost-effective supply chain security practices with the trade community, Customs can help to lower one barrier to certification, that is, the cost of certification. We see this as serving to vividly cast Customs as a genuine inter-organisational citizen in the trans-border trade environment rather than as a government body so focused on pursuing its own agenda that it becomes inadequately attentive to the trade community's real concerns. This point about inter-organisational citizenship behaviour is especially germane to our final recommendation: evaluate suggestions to overcome border obstacles to legitimate trans-border supply chains using simulation models that capture performance metrics *of relevance to all parties*. This recommendation stems from our previously noted observation that the discourse among the trans-border environment's commercial stakeholders reveals a plethora of suggestions for overcoming the perceived obstacles. On the surface, many of the suggestions seem to make sense intuitively. However, unless the operational realities associated with a suggestion are rigorously tested to gauge its effects on the different parties, implementing it would be irresponsible. Therefore, along the lines of our computer simulation study of an appointment system for trucks, we recommend judicious use of computer simulation to test suggestions of interest. Keys to judicious use include clear understanding of obligations that the suggestion might impose on the various parties (Customs, the trade community, etc.). This requires honest, open, and objective dialogue that conforms to exemplary inter-organisational citizenship behaviour. Such dialogue will also help to ensure that the computer simulation model's performance metrics reflect what is important to these parties.

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Endnotes

- 1 The authors are grateful to the Social Sciences and Humanities Research Council of Canada (SSHRC) for its financial support of this research project (Research Grant #864-2007-0170).
- 2 Stephen Rigby 2009, 'Towards modern border management', *I.E. Global*, Spring, pp. 16-18.
- 3 Also known as IE Canada.
- 4 Examples of Simon's work that readers may consult include Simon 1955, 1972 and 1976.
- 5 Though we recognise the strong corroboration of our survey insights with observations from other empirical methods we employed, we caution that our survey results are based on a small convenience sample. This sampling procedure suffices for our research objectives which do not include making authoritative statistical generalisations based on strict probability sampling.
- 6 An example of reports that capture this concern is the joint Canadian and US Chambers of Commerce report titled, 'Finding the balance: reducing border costs while strengthening security', viewed 13 July 2008, www.chamber.previewsite.ca/images/uploads/Reports/finding-the-balance.pdf.
- 7 <http://cbsa-asfc.gc.ca/agency-agence/reports-rapports/ae-ve/2006/pip-pep-eng.html>.
- 8 Presentation by CBSA official during session titled 'Harmonization of C-TPAT, PIP and AEO' at CAIE 18th Annual Conference on 'Emerging issues in customs and trade compliance', 20-22 April 2009.
- 9 See Diop & Hartman 2007.
- 10 *Supply chain security best practices catalog*, pp. 1-2, 17-18, viewed 11 July 2008, www.pac-am.com/docs/CTPATBestPractices.pdf.
- 11 See Prentice & Hickson (2007) for a detailed discussion of security benefits.
- 12 See, for example, the report on such a survey by the Ontario Chamber of Commerce, 'Easing the chokepoints: a plan for an efficient Canada-US border', pp. 49-50, viewed 1 July 2008, www.ontariochamber.org/Policy/Reports/340.
- 13 Examples are 'Easing the chokepoints: a plan for an efficient Canada-US border', viewed 1 July 2008, www.ontariochamber.org/Policy/Reports/340 and '2008-2009 Ontario-US border policies', viewed 20 September 2008, www.ontariochamber.org/Policy/Reports/412.
- 14 'Is just-in-case replacing just-in-time?: How cross-border trading behaviour has changed since 9/11', viewed 11 July 2008, www.conferenceboard.ca/documents.aspx?DID=2050.

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