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Exploring the use of external data for supervision

Food and feed Safety Supervision in the Netherlands for internationally traded Goods: Do Customs Data matter?

Esther Enning
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RSM Erasmus University
ROTTERDAM SCHOOL OF MANAGEMENT
ERASMUS UNIVERSITY

Executive Master in Customs and Supply Chain Compliance

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Author	Esther Enning e.f.enning@nvwa.nl
Programme	Executive Master in Customs and Supply Chain Compliance RSM – Rotterdam School of Management Group 2017-2020

Committee

First supervisor	Dr. T. Verduijn TU Delft, Transport and Logistics HZ University of Applied Sciences, Supply Chain Innovation
Second supervisor	Dr. J. Hulstijn Tilburg University, School of Economics and Management Department Management
NVWA supervisors	M. Colijn NVWA, Directie Strategie Afdeling Beleid, planvorming en instrumentontwikkeling (BPI) R. van Buuren NVWA, Directie Handhaven, Divisie Regie & Expertise Afdeling Expertise, Teamleider team Expertise Industrie

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In September 2017 I have started to study. Again.
It has been quite a journey. Initially I expected finding and keeping a doable balance between work, private life and on a study on top, to be my biggest challenge. Mostly, I was looking forward to learn. Go studying again turned out to be the easiest part, the long consecutive days in class appeared a more substantial challenge. Luckily there were my classmates: it was a true pleasure to study with them. Jeroen, Onno and Martijn in particular: if things got challenging, be it in- or outside the programme, we would always have our group to lean on!

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Thank you all. For allowing me to study as I did, and enjoying it. Again.

Thanks a million,
Esther

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Preface

Executive summary

The NVWA is the designated authority to supervise on food and feed safety in the Netherlands, from "farm to fork". However, data are lacking to monitor internationally traded goods, effectively and efficiently. Customs data use, requires overcoming issues, such as the non-uniform goods identification caused by non-aligned EU regulations. The ongoing evolution of, and increase in supervisors' data use, facilitated by available technology and encouraged by waning budgets, create the need for additional data, resulting in increased data dependence and the need for secured data availability.
This research aims to create a theory on external data use, in supervision. The practical contribution of this research supports the monitoring of internationally traded goods, both inside and outside the Netherlands. The future of supervision includes shared data usage for supervision; exploring current data use is a useful first step towards a joint digital inspection facility. Therefore, the main research question is

What is the impact of case-based Customs data on the food and feed safety supervision of internationally traded goods in the Netherlands?

Supervision, comprised of acts that establish compliance, is essential in any legal system, to ensure regulatory goals are met, to mitigate societal risks, such as food and feed safety. Effective supervision is responsive, embraces tripartism, and promotes compliance. Efficient supervision spends its capacity selectively, while prioritizing the most significant risks, based on risk management. External data use ensures continuity and enhances all phases of the supervision.

External data use provides insight into domains and risks, improving data, predictions, and subject identification. Moreover, gaming, overlap and underlap are limited, while actions are better-informed and tailored, and interventions experience increased consistency. Additionally, trough external data use, reports and evaluations improve, while actions and decisions can be substantiated. The efficiency and outcomes of supervision can be measured, but causality is difficult to claim; thus, outcomes must be questioned, especially with risk-based supervision that is selective by nature. Effects can be explained via factors that cannot guarantee success, since legislation may prevent this from happening.

This research used exploratory and qualitative research, to gain knowledge and understanding by creating a theory in the field of interest not extensively studied in previous research. The collected historical data in this research required a cross-case analysis. Thus, two types of interviews were conducted: expert interviews about data requests, and stakeholder interviews about the process. A survey identified factors that determine success via a single case study to investigate the consequences of on non-aligned EU regulations. Nevertheless, the COVID-19 crisis caused adjustments in the data collection; therefore, five interviews were conducted via telephone, and the survey was conducted via email.

The validity and reliability of the research were ensured, using multiple tactics. Moreover, the conceptual model was partly operationalised, and identified the phases directly influenced by the data use because Customs data serve as input. These phases are compliance prediction (phase 2), preparation of supervision (phase 3), and compliance detection (phase 4). After addressing issues, when external data was available and securely accessed, the use of this external data improved data quality, as formerly unknown subjects were detected, other subjects were identified more accurately and timely, and signals and trends were responded to in a more timely manner. In one instance, even fraud was detected.

External data use allows for attunement of actions to the determined risks, reducing gaming, overlap, and underlap, which requires less capacity. In this way, available capacity can be planned more effectively and efficiently. Moreover, external data can (partially) replace monitoring to check compliance, providing improved focus during inspections by better-informed inspectors for more effective supervision. Trough external data use, the consistency of subject selection is enhanced,

and tailored inspections are less uniform but more efficient and effective. However, there is room for improvement in the prevention of overlap and the use of technology.

Data on performed evaluations were not useful to this research because the NVWA evaluates via other means. The factors that determine success are manifold, with trust as the most critical factor. Other factors include the data, and the technology to use them, people in the system, the network, and the importance of applying societal information to supervision.
Therefore, the discussion in this research focuses on the continuity, responsiveness and evaluation of supervision, the concept of unnecessary inspections, tripartism in the General Food Law (GFL), and bias in selective supervision.

In response to the sub research questions, the external data use transforms the supervision (sub-question 1) into an enhanced and continuous process when experts can give meaning to data; however, there is room for further improvement when extending and supporting data use. There is room for further improvement when extending and supporting the data use.
Supervisory effects can be evaluated (sub-question 2) at the micro-level, macro-level, and meso-level. Nevertheless, measuring is challenging, and claiming causality is difficult in risk-based, selective supervision.
Successful external data use can be explained by factors (sub-question 3), based on their importance and feasibility. Trust, however, overrides all factors. The NVWA must overcome issues to obtain Customs data (sub-question 4), with room for improvement in the use of technology for data analysis. Finally, data usage results (sub-question 5) in more effective, efficient, and less intrusive supervision that better adheres to public values.

In response to the main research question, external data use enhances supervision via effectiveness, efficiency, intrusiveness, and adherence to public values. Supervision becomes a continuous process, that is more effective, based on better data, towards better-identified subjects.
Data usage can be further developed to contribute to a better distribution of roles, responsibilities, and liabilities in supervision. Thus, Customs data do matter.

Despite the limitations of this research, it contributes to envisaged knowledge and theory on external data use for supervisory purposes as well as knowledge on external data usage for monitoring internationally traded goods. The recommendations for further research include a follow-up on an international scale, the possibilities of applying positive interventions to promote compliance, the optimal organisational form for future shared data usage, and research on data quality.

Key words: Food safety, feed safety, supervision, monitoring, NVWA, Customs, cooperation, entry, import controls, risk-based, data-driven, data use, external data.

Content

Abbreviations

AGS-i	"AanGifteSysteem - invoer" Customs application that processes import declarations for free circulation in the EU. To be renamed into DMS before July 2021
AGS-u	"AanGifteSysteem -uitvoer" Customs application that processes export declarations for union goods leaving the EU
AVG	Algemene Verordening Gegevensbescherming – Regulation (EU) Nr 2016/679, the *General Data Protection Regulation (GDPR)*
BTI	Binding Tariff Information, a Customs specialism to classify goods according to the Harmonised System
CN code	The 8 digit number to classify goods according to the HS system
CSFs	Critical Succes Factors
DMF	Douane Manifest. Customs system that supports the process of entry into the EU (UCC art. 33.1). This application holds goods that enter the EU via sea, Maritime.
ECS	"Export Control System" Customs application that processes all shipments that leave the territory of the EU
EORI	Economic Operators Registration and Identification number. Identification number for companies to be used for all Customs procedures
EU	European Union, a union of member states located primarily in Europe, established via the Maastricht Treaty that came into force in 1993.
FCM	Food Contact Materials, according to Regulation (EC) No 1935/2004
GFL	The General Food Law, the EU framework to ensure food and feed safety, Regulation (EU) nr. 178/2002
GPA	"Geautomatiseerde Periodieke Aangifte" Customs application that periodically processes the import declarations of importers
HS	Harmonised System to classify goods worldwide in the same manner HS Chapter - 2 digits, HS Heading - 4 digits, HS Sub-heading - 6 digits, CN Sub-heading - 8 digits, TARIC Sub-heading - 10 digits
IT	Information Technology
NCP	National Control Plan or monitoring; to monitor the safety of food and feed in the EU by Member States, based on article 44.1 of the Official Control Regulation (OCR)
NCTS	New Computerised Transit System, the application that administers non-union goods that have entered the EU territory but are not yet in free circulation. According to art. 227 etc of the UCC.
NVWA	"Nederlandse Voedsel- en WarenAutoriteit", the Netherlands Food and Consumer Product Safety Authority
OCR	Official Control Regulation, Regulation (EU) nr. 2017/625
OECD	Organisation for Economic Cooperation and Development. An intergovernmental economic organisation that aims to stimulate economic progress and world trade
RAPEX	European system to inform other EU member states on detected risks that concern product safety issues, including risks with Food Contact Materials (FCMs)
RASFF	European system to inform other EU member states on detected risks that concern food or feed safety
RIF	Risk Information Form, European Customs system to inform other EU member states on detected risks. RIF is the equivalent of REPEX and RASFF – that target other risks.
TARIC	Integrated Tariff of the European Communities – a ten digit code to classify goods according the Harmonised System (HS).
UCC	The Unions Customs Code (UCC), Regulation (EU) Nr. 952/2013
VENEU	Customs application to process declarations of consignments that enter or leave the EU by post or courier. The application used for e-commerce consignments.
WCO	World Customs Organisation, amongst others has developed the HS system
WTO	World Trade Organisation

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1. Introduction and research problem

Following the introduction, this chapter outlines an overview and motivation of the research.

1.1 Introduction

The NVWA is the designated authority to supervise on food and feed safety in the Netherlands, from "farm to fork" (EU a, 2020). That includes non-EU goods when they enter the EU, or EU-goods that leave the EU. Supervision must be conducted as efficiently and effectively possible, to be executed risk-based and data-driven (Ministeries van VWS en EZ, 2015). A challenging task, given the large volumes entering and leaving the EU every day, via the port of Rotterdam and Amsterdam airport. By EU law, trade is obligated to notify the arrival or departure of goods to the NVWA, subject to refundable controls. In turn, the NVWA is obligated to monitor all other products, those are not similarly notified. Hence, the NVWA lacks knowledge for efficient and effective monitoring.

Cooperation with Customs and the use of their supervisory data has shown that Customs data compensate for the missing information, when supervising internationally traded goods, pose Respondents N in an interview. Initially, Customs data only served the operational purpose of signalling consignments at entry. Over the years, the use of Customs data increased and evolved. To more data, from an increased number of sources and attention on interrelationships between data, and data usage for multiple purposes. This increasing data usage subsequently caused an increased dependence on Customs data. Meanwhile incidentally the data exchange temporarily stagnated. Moreover, both organisations have been reorganised on more than one occasion: employees on whom the data exchange depends, changed positions. Hence the need for a secured data availability. The difference in goods identification as a result of non-aligned EU legislation, remained.

Data-driven supervision is promising; the NVWA has the task and ambition to improve the use of data, including external data. But the current use of Customs data for monitoring, is not documented, secured or anchored. Exploring the data use is a first step in that direction.

Concluding, the main problem in this thesis is the use of external data for the supervision on internationally traded goods.

1.2 Research questions

The main research question of this research is:

> *What is the impact of case-based Customs data on the food and feed safety supervision of internationally traded goods in the Netherlands?*

Around the year 2000, the NVWA started to cooperate with the Dutch Customs Administration for monitoring the food and feed safety of internationally traded goods. Customs data completed the NVWA's information position and mainly focussed on products. The case-based historic data enabled risk-based and data-driven supervision: insight on supply chains was gained. That insight was subsequently used to have Customs signal the entry of potentially risky consignments. From the signalled consignments, the NVWA would selected a part for an inspection. Inspection and sampling would prove compliance of a potentially risky product, and thus if it could enter the EU. Hence, the supervisor may have appeared responsible for preventing unsafe products to enter the EU.

Over time, the supervisory focus shifted from products towards the ones responsible for compliance: companies. Supervision would establish if a company was capable of coping with risks if these would occur. Supervision changed due to its shifted focus and caused a need for other, and more data. Currently, Customs data, in addition to their operational use as input for inspections, also serve to

prepare projects, and even replace inspections based on data-analysis. The analysis increasingly relies on interrelationships between datasets rather than a on single source.

This use of external data impacts the supervision, by making it more effective, efficient, less intrusive and adhere to public values. More effective by leaving autonomy for the one supervised, when not sampling consignments but rather focussing on a companies' compliance efforts (Baldwin a & Black, 2008). More efficient, by limiting supervisory efforts to what deems necessary based on data analysis (…). Less intrusive, by preventing unnecessary inspections based on data analysis (…). And adhere to public values when it can help to legitimise supervisory actions, for instance by being transparent, accountable and via the use of available capacity (Sorgdrager, 2019), (WRR, 2013).

The current use of Customs data for the supervision on internationally traded goods is visualised in the following figure, the impact model.

FIGURE 1

Impact model on the use of Customs data for Supervision on internationally traded Goods

The sub-research questions that must support the answer to the main research question for the literature review part are:
Q1. How has the use of external data changed the supervision and why?
Q2. How can supervisory effects be evaluated?
Q3. Which factors determine the occurrence of the effects?

The empirical research part aims to answer these sub-research questions:
Q4. What restrictions and problems have the NVWA experienced in the retrieving and analysing of Customs data, and what has been the impact on the effects?
Q5. What is the effect of the data use, in terms of benefits to regulatory effectiveness and efficiency, intrusiveness and public values?

1.3 Research motivation

The NVWA always administered their supervisory data, starting with inspection data to support actions and to have proof in case any objections or court cases would arise in response to actions. Currently there is a need for more data and data serve multiple purposes, including risk assessment and reporting for accountability purposes, such as on the input and effects of efforts (See Annex 2, Annex 5). The increasing data usage causes the need for other data, and for an increased dependence on data, hence requiring a reliable data availability.

Meanwhile incidentally the data exchange from Customs to the NVWA has (temporarily) stagnated for different and sometimes unknown reasons, usually unannounced and for an unknown period, what conflicts with the NVWA's increasing data need, hence the need to secure the data use. Additionally, the exchange of Customs data used to depend amongst others on the professional network of employees. Since both organisations have been reorganized more than once with employees changing jobs, and a future change cannot be excluded: securing the data availability seems legitimate.

The legal EU landscape towards the use of data has developed, currently EU Privacy legislation aims to guarantee that personal data will be carefully processed, used and kept. This development influences all data use, purpose binding gained importance. Ideally, the current data use provably meets all legal requirements. For instance the Official Controls Regulation (OCR, Regulation (EU) nr. 2017/625) came into force: one new key element is competent authorities should take fraud into account when deciding the appropriate frequency of controls. However, since common inspections will not be effective (Gussow, 2020), data may enhance the detection of fraudulent actions (Scherpenisse, Schram, & van Twist, 2017), (Griffiths, 2019).

Within supervision there is a need for research and innovation towards data use. According to the "Wetenschapsagenda Toezicht" (van der Steen & van Erp, 2018) there is a strong need for innovative, knowledge-driven, risk-based approaches. Some themes elaborate upon big data, data science and data sharing. However, the apparently promising data use fits the calls to strengthen supervision may not fit waning budgets and investments that advanced data use require (Bal a, Leistikow, & Stoopendaal, 2017).

The use of data gains importance and is promising. Ambitions towards data use are not restricted to the NVWA or Customs. Additionally to the joint inspection facilities, the future might hold a joint digital inspection facility with shared use of data and analyses, creating a super vision for even better supervision. Academic literature on the use of externa data for supervision is limited. Consequently, when considering this a call for this thesis, exploring the current data use might be a first step towards a joint digital inspection facility.

1.4 Research scope

The focus of this thesis is the use of external data, for supervision on internationally traded goods, on their food and feed safety, in the Netherlands. The applied delineation criteria concern the context, modality, time, activity (Baxter & Jack, 2008) via (Asimiran & Nije, 2014).

External data being supervisory data, obtained from the Dutch Customs administration, from various systems. These include include Entry Summary Declaration (ENS) data on the entry of goods from the application called Douane Manifest (DMF). Import declaration data, from the AanGifteSysteem (AGS-i), or, from the Geautomatiseerde opgave (GPA) system. Export declaration data, from the AanGifteSysteem (AGS-u) system. Exit data from the Export Control System (ECS). Transit data obtained from the New Computerised Transit System (NCTS).

Supervision, as performed for the National Control Plan (NCP), called monitoring. This monitoring excludes refunded controls based on the high risk of goods, or for EU emergency measures. Because only with monitoring, the designated supervisor lacks data on consignments. Moreover, with monitoring, the EU legislation leaves most leeway to EU Member states in designing their supervision, attuned to their National situation. For example, in the Netherlands, monitoring is performed risk-based and data-driven on behalf of the commanding ministry.

This research focuses on so-called first-line supervision: direct NVWA supervision. Second-line supervision where the NVWA supervises another (first-line) supervisor, is excluded from the scope. Because in practice it is easiest to influence one's own data use, and eventual benefits can contribute to the NVWA's ambition on data use.

Internationally traded goods are defined for this research as non-Union goods that enter the EU, or union goods that leave the EU. The focus is on the most likely benefits from using Customs data, hence, supervision on the internal market (on union-goods) is excluded from the research scope.
Towards the modality, the focus is on maritime shipments, at entry, import, export or exit of the EU: the most commonly used modality for goods subject to monitoring.

Food and feed safety is the goal of the General Food Law (GFL), the EU law that must protect consumers, animals, plants and the environment. The designated supervisor, the NVWA in the

Netherlands, also has a task towards many other risks and domains, such as veterinary and phytosanitary risks. These are excluded from the scope for the manageability of the research.

Timewise, this research will collect data concerning the supervision from 2017, 2018 and 2019. Given the nature of the study, older data are not considered to add value to this research.

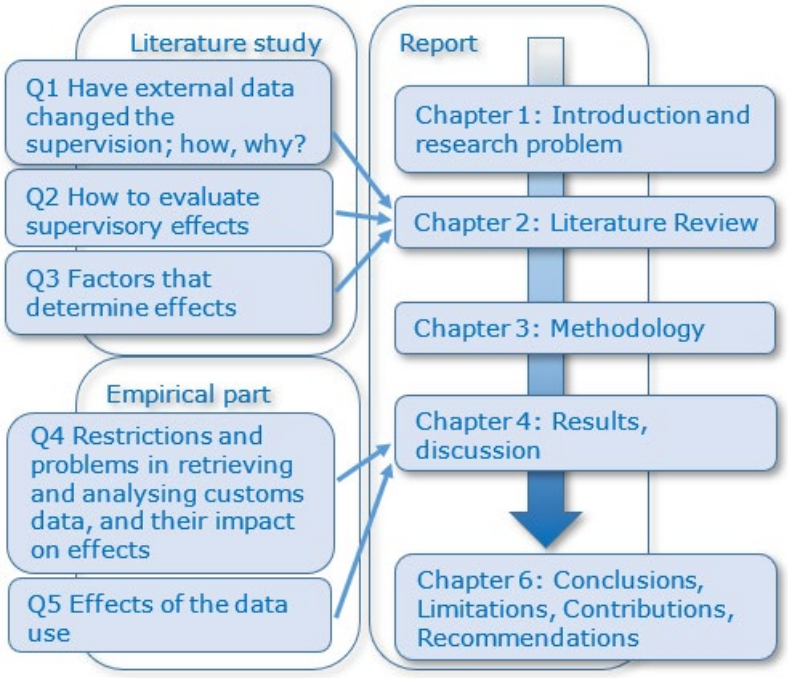
1.5 Structure of the thesis

The literature review aims to establish what is already known, to determine if this research can contribute knowledge to the detected knowledge gap. From the literature review findings, a conceptual model will be constructed. To learn if effects from literature also occur in practice, data will be collected from multiple sources and types. Key are historical data requests and interviews. Stakeholder mapping must facilitate the completeness of the interviewee selection. For generalisations, a survey at tactical level will be conducted, amongst NVWA inspectors familiar with Customs cooperation from other NVWA fields of interest. In the final chapter conclusions will be drawn, whether the theory that the conceptual model presents, can be validated. The research and its outcomes are be presented in this thesis report, with a structure the following figure presents.

All pillars of the Master programme, being Customs, IT/ Compliance, and Supply Chain will be elaborated upon.

FIGURE 2

Structure of the Thesis



1.6 Relevance

This research contributes to the theory on the use of external data, obtained from other supervisors, for the purpose of supervision on internationally traded goods. Literature about such data use is limited (Mertens b, 2017).
This research has a strong practical relevance to the food and feed safety supervision in the Netherlands, whether the described data use can enhance its effectiveness and efficiency, decrease intrusiveness and contribute to public values. Moreover, others supervisors in the Netherlands that supervise internationally traded goods could benefit from this research. Additionally, other designated authorities in other EU member states that have a similar legal obligation to monitor

internationally traded goods, may benefit. That includes other fields of interest such as the phytosanitary or veterinary domain.
The use of external data, being supervisory data from Customs, may also enhance supervision on other risks than food and feed safety, by other supervisors. However, the different focus, the data may be related to internationally traded goods. This is confirmed during an interview with an officer of the National Police (Respondent V), whom supervised a study in that area.

Summary of Chapter 1
The NVWA is the designated authority to supervise on food and feed safety in the Netherlands, from "farm to fork". However, data are lacking to monitor internationally traded goods, effectively and efficiently. Customs data use, requires overcoming issues, such as non-uniform goods identification due to non-aligned EU regulations. The ongoing evolution of- and increase in the supervisors' data use, facilitated by available technology and encouraged by waning budgets, create the need for additional data, resulting in increased dependence on data, and secured data availability.
Hence, this research aims to a build theory on external data use, in supervision. The practical contribution serves the monitoring of internationally traded goods, inside and outside the Netherlands. The future of supervision includes shared data use, exploring the current data use is a useful first step towards a joint digital inspection facility.

Reading notes
Notably, for the readability of this thesis report, from this paragraph on "the supervision on internationally traded goods for their food and feed safety", will be referred to as "the supervision". "The data" or "the data use" refers to the use of case based, supervisory Customs data, requested as input for the supervision.

Monitoring the food and feed safety is a legal obligation to the NVWA, based on article 44.1 of the Official Control Regulation (OCR). Monitoring is also referred to as the National Control Plan (NCP) controls, in interviews.

2. Literature review

This chapter presents the literature review; the theoretical background of this research. Starting with supervision; risk-based, data-driven and when adding external data. Followed by evaluation of the effects of supervision, and factors that can determine success. The chapter concludes with the construction of the conceptual model of this research. For readability, reviews on sources used, are presented at the end of each section.

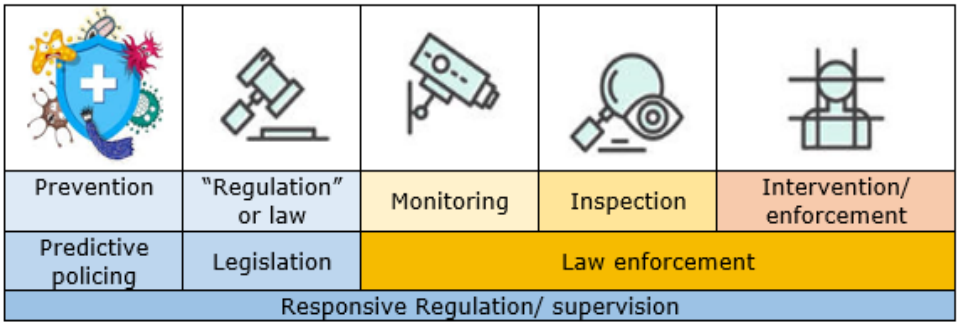
2.1 Supervision, the consequence of external data use

Supervision
This section delineates respectively the definition, the scope, the essence, tripartism, the conditions for good supervision, being (1) effectiveness, (2) efficiency, (3) intrusiveness, and (4) public values. Following the phases of supervision, and a summarising table are presented.

There are many definitions for supervision, with the outreach and operationalisation as the most essential difference (Ayres b & Braithwaite, 1992), (OECD, 2014), (Sparrow, 2000). The broad definition obtained from critical research aligns best with this research: "legally legitimate influence on certain aspects of behaviour ... in order to better achieve a socially desirable pattern of behaviour" (Mertens a, 2011). To its core essence, supervision influences behaviour to achieve the legal objectives, stimulate that compliant behaviour occurs or non-compliant behaviour does not occur (Baldwin c, Hood, & Rothstein, 2001).
The outreach of the term supervision is interpreted differently. Viewed narrowly, supervision sees upon the essence of the work of an inspector: gather- and assess information (Brunia & Velders, 2013). Interpreted to its broadest concept supervision overarches all efforts and includes any act to promote compliance, including all activities that must ensure legal requirements are met. The following figure shows the scope of concepts relevant to this research, in relation to each other.

FIGURE 3

Concepts related to Supervision and their Outreach



A legal system cannot do without supervision; it is an essential task to ensure the goals of the legislation are met. Especially towards the risks society cannot bear on its own (Beck, 1992). Public risks, such as food and feed safety, are always present, because they result from a network with many different stakeholders; society. Managing public risks, using supervision, is progressively challenging due to the increasingly complex and 'polycentric' (Janssens, 2017).
Janssens *(2017)* contribution generalises non-founded, from supervision on education to supervision in general. Only the substantiated part on polycentric supervision is used for to this research.

The concept of Responsive Regulation, commonly visualised by the regulatory pyramid, represents responsiveness and tripartism in regulations (Ayres b & Braithwaite, 1992). Responsive regulation implies a flexible response to findings; responses represent regulatory strategies with increasing coerciveness. The supervisor can scale up the interventions to a more coercive tactic if voluntary tactics do not result in compliance. Non-compliance can be caused by not knowing, not being willing or not being able to comply. For example, hard-cut rules from rule-based regulation, such as a quantitative limit (maximum of 4 ppb Aflatoxin b1), are easier to understand and implement than principle-based regulation, such as a descriptive requirement ("safe food") (Burgemeestre, Hulstijn, & Tan, 2009).
Tripartism must prevent ending up in a game of power or money, by adding a third party to the supervisor and the one supervised (Ayres b & Braithwaite, 1992), the party the regulation targets. Thus, the supervision must be flexible and, in case of food and feed safety, include consumers.

To be effective, regulations should enable autonomy to the one supervised, leaving leeway for responsiveness (Ayres b & Braithwaite, 1992), (Baldwin a & Black, 2008). The supervisory strategy can stimulate autonomy in two directions; positive, gearing towards compliance (Ayres b & Braithwaite, 1992), or negative, focussing on deterrence (Kagan & Scholz, 1984). Both forms can reduce harm (Simpson, 2002), but no single approach serves all situations equally well. The positive strategy can better anticipate societal changes (Power, 2004), and prevails from experience (Chapadar, 2020), (Gunningham, 2015). Thus, a supervisor should apply a positive strategy by promoting compliance and leaving room for autonomy to the one supervised, to act effective.

To remain effective, regulations should keep up and align with contextual changes (Almond & Esbester, 2018). Regulation did evolve in a "smart" direction, applying trispartism and responsiveness (Grabosky & Gunningham, 1998). Supervision evolved from initial "expert-based", whereby the inspector acted as the expert, towards more responsive (Ayres b & Braithwaite, 1992), risk-based and governance-based towards legitimacy and accountability taking risks into account (Black, 2008) and increasingly relying on data (Almond & Esbester, 2018). Thus, supervision remains effective when it is responsive, applies tripartism and governs the role distribution.

Efficient supervision does not check everything, that is impossible (Power, 2004), and is unwanted, from the viewpoint of Responsive Regulation (Ayres b & Braithwaite, 1992) because it conflicts with the autonomy of the one supervised. Therefore, supervisory efforts must be spent proportional to the risk for society. Sparrow (2000) suggests to spend the capacity on finding and solving the most significant problems, then communicate about it. But establishing a proper balance between risks, data and expertise is challenging. Being selective implies taking risks; so called public risk governance (Rhodes, 1996) via (Andreeva, Ansell, & Harrison, 2014). Thus, efficient supervision spends its capacity selectively, is based on risk management, and prioritizes the most significant risks.

Selective supervision not only influences the efficiency of a supervisor. Being selective in actions that require companies to participate, prevents unnecessary hindering legitimate actions. This in turn, contributes to trade facilitation. Thus, a supervisor must be selective in its actions that hinder trade, to limit the intrusiveness to companies.

Moreover, supervision should adhere to public values that constitute from transparency, public accountability and sufficient capacity, consequently this can help to legitimise actions (Sorgdrager, 2019), (WRR, 2013).

Seven different supervisory phases can be distinguished. Prior to an inspection, supervision can prevent non-compliance (1) (Willis, 1926), by encouraging compliance (Mertens a, 2011), (Baldwin b & Black, 2010), (Chapadar, 2020), for instance via information on occasion called "sermons" (McCormick, 1998).
Supervision can analyze to predict compliance (2), the searching for problems can also function as a precondition for prevention (Foucault, 1975), (Peeters, 2014).
The following phase is preparing actions (3), to ensure the right action is taken, in the right way, at the right place and right time, by the right person (Mertens a, 2011).

Supervision to establish compliance (4) is the essence of an inspection, collecting and assessing data. Post inspection, in response to established compliance, a supervisor can intervene (5) reparative, punitive and preventive with the aim to prevent occurrence and recurrence of non-compliance (Mertens a, 2011). Also post inspection is the measurement of outcomes (6) and the evaluation of supervision (7) (Sparrow, 2000), (Sorgdrager, 2019), (WRR, 2013).

The following table lists the relevant contributions from literature, per supervisory phase.

TABLE 1

Theories on Supervision per phase of a Supervisory Process

	Supervision	Theories
Prior to an inspection	1. Prevent non-compliance	• Prevent non-compliance (Willis, 1926), (Baldwin a & Black, 2008), (Chapadar, 2020), (Mertens a, 2011) - by enhancing the willingness, the knowledge or ability to be compliant (Ayres b & Braithwaite, 1992) - via sermons, being information (McCormick, 1998).
	2. Analyse domains or risks to predict compliance	• Find all problems, i.e. by analysing (Sparrow, 2000) • Supervision, i.e. monitoring, can function as a precondition for prevention of non-compliance (Foucault, 1975), (Mertens a, 2011), (Peeters, 2014).
	3. Prepare supervisory actions	• Prepare the supervision i.e. by inspections or based on administration (Mertens a, 2011), (Peeters, 2014).
Inspection	4. Supervise, check compliance	• Supervising, i.e. by inspections (Peeters, 2014) • Find problems, i.e. detected non-compliance during inspections (Sparrow, 2000) • Ensure responsiveness in regulations and supervision to promote compliance (Baldwin a & Black, 2008).
Post inspection	5. Intervene on compliance	• Solve problems, by intervening in case of non-compliance (Sparrow, 2000) • Reparative, punitive or preventive interventions (Mertens a, 2011) • Intervene but not only with a stick (punishment): an intervention should suit the situation (Ayres b & Braithwaite, 1992).
	6. Measure outcomes of supervision	• Measure the outcomes of supervision i.e. compliance level to legitimise supervisory actions (Sorgdrager, 2019), (WRR, 2013).
	7. Evaluate supervision	• Communicate about the supervision after having solved the most important problems (Sparrow, 2000) • Adhere to public values by evaluating the capacity and by being transparent (Sorgdrager, 2019), (WRR, 2013).

Literature review: the usability of the literature used varies, in rigour and operationalisation. The literature on supervision that is general, offers principles, but has not been operationalized, nor validated against developments such as the use of external data. Nevertheless, given their general nature, the principles are applicable to this research. This concerns the material of Ayres & Braithwaite (1992), Baldwin & Black (2008), Beck (1992), Foucault (1975), Kagan & Scholz (1984), Power (2004), Simpson (2002), Sparrow (2000) and Willis (1926).
A number of sources did operationalise, based on a model, building on existing theories. Given that operationalisation and their rigor, these are applicable to this research. This concerns the material of Baldwin, Hood & Rothstein (2001), and Mertens (2011). Most contributions, descriptive and comparative by nature, and relatively recent, do not apply a model, or apply to another context such as education (Janssens, 2017). Of these, only relevant substantiated and generalisable parts are used, so as not to compromise the robustness of this research. This concerns the material of Almond and Esbester (2018), Brunia & Velders (2013), Burgemeestre, Hulstijn, & Tan (2009), Coglianese & Mendelson (2010), Janssens (2017), Rhodes (1996) via Andreeva, Ansell, & Harrison (2014), Sorgdrager (2019), and WRR (2013).

Risk-based supervision

This section defines risk-based supervision, explains the need for it, presents advantages and disadvantages, and concludes with a table listing the relevant literature per phase.

Risk-based supervision is defined as supervision where efforts are prioritised, based on the risks to be addressed, with priority to the highest risks (Helsloot & Scholtens, 2014), (Sparrow, 2000). A

welcome approach, as supervisors cannot control everything and should therefore be selective (Power, 2004). Moreover, controlling everything is objectionable, based on the responsiveness that Responsive Regulation recommends (Ayres b & Braithwaite, 1992), and since most companies aim to be compliant (Custers a, 2014).

Risk analysis can facilitate a proportionate and effective response to issues without compromising safety (Mertens c, Scherpenisse, & van der Steen, 2014). The use of risk indicators can make supervision more consistent and consequent (Borghans & Robben, 2014) by adding focus to target risks rather than randomly inspect. Consequently, it is considered to be better, compared to expert-based supervision: it is more productive in effectively addressing risks and more efficient use of available capacity. Additionally, the supervision is less intrusive to legitimate trade which does not suffer costs or delays from unnecessary inspections (Helsloot & Scholtens, 2014), (Kockelkoren, 2014), (Honingh & de Wolf, 2014). After the actions have taken place, that were based on a completed picture of the risk or domain, the evaluation improves; the data can facilitate the reporting (Mertens c, Scherpenisse, & van der Steen, 2014).

The perception of being supervised influences compliance behaviour (Foucault, 1975): in theory, risk-based supervision positively influences compliance. But supervising occasionally does not suffice (Mertens a, 2011), thus there must be continuity. Furthermore, risk-based supervision is based on risk assessment, that relies on the risk information available. In practice, not all risks are known and measurable: blind spots are inevitable (Bach & Wegrich, 2018), (Honingh & de Wolf, 2014). *This leaves* some risks worth addressing, out of scope and thus unaddressed (Power, 2004), (Sparrow, 2000). Literature recommends risk-based supervision though: the advantages, including increased effectiveness and efficiency, outweigh disadvantages.

Concluding that risk-based supervision enhances four phases; compliance prediction (phase nr. 2), preparation (phase nr. 3), supervise to check compliance (phase nr. 4), and evaluation (phase nr. 7).

Literature review: From the general literature that is not operationalised nor validated against recent developments, principles are used for this research. This concerns the material of Ayres & Braithwaite (1992), Foucault (1975), Power (2004), and Sparrow (2000). Contributions with operationalisation, useful given their part on risk-based supervision, concern the material of Bach & Wegrich (2018), and Mertens (2011). From all other materials, only substantiated, generalisable parts were used.

Data-driven supervision
This section explains the origin of data-driven supervision, presents advantages and disadvantages per phase and an important precondition.

The expert-based supervision, started years ago and consisted mainly of performing physical inspections to monitor compliance. Data mainly served to record findings as evidence. But an inspector cannot be everywhere and see everything; bias and blind spots are inevitable (Honingh & de Wolf, 2014), (Bach & Wegrich, 2018). The introduction of information technology (IT) and waning budgets stimulated inspectorates to apply a risk-based approach, building on the inspectors' expertise. Consequently, supervision shifted from observing goods towards investigating a companies' risk management. Data additionally serve to report activities, and as input for future risk assessment (Mertens a, 2011). Meanwhile, the availability of continuous developing IT and data science supported enhanced data use. Moreover, inspectorates apply behavioural science, such as via variation in the supervision, to promote compliance. Subsequently, inspections that required a company visit, are more focused or replaced by an data analysis. Data additionally are used to detect anomalies that may represent risks when monitoring compliance, for enhanced risk management, evaluation and reporting (Mertens c, Scherpenisse, & van der Steen, 2014).

Risk-based supervision requires data about risks. Data are input for monitoring future risks, and assessing risks; a part of the risk management (Mertens c, Scherpenisse, & van der Steen, 2014). Data can serve to detect interesting patterns when feeding these to existing models with the aim to optimise future *supervision* (Mc. Ewen 2002) via (Hollywood & Winkelman, 2015). When preparing supervision, data can serve as input for future inspections (Mertens a, 2011). When supervising to

check compliance, data can serve as input for the administrative recordings of findings (Mertens c, Scherpenisse, & van der Steen, 2014), and to assess compliance or effectiveness of intervention strategies (Mertens a, 2011). Data can facilitate performance measurement, (Mc. Ewen 2002) via (Hollywood & Winkelman, 2015), and serve for reporting (Mertens c, Scherpenisse, & van der Steen, 2014).

"Data will change your decisions and the way they are made" (Ayres a, 2007); hence, data quality is very important. Hence, it matters that data are administered as complete and correct as possible (van Dishoeck, et al., 2013), and that inspectors act uniform and consequent (Mascini & van Wijk, 2008).

Concluding that risk-based and data-driven supervision improves five phases; compliance prediction (phase nr. 2), preparation (phase nr. 3), supervise to check compliance (phase nr. 4), measure outcomes (phase nr. 6), and the evaluation (phase nr. 7).

Literature review: From the general literature that is not operationalised nor validated against recent developments, principles are used for this research. This concerns the material of Ayres (2007). Contributions with operationalisation that are useful given their part on data-driven supervision, concern the material of Bach & Wegrich (2018), and Mertens (2011). From all other materials, only substantiated, generalisable parts were used.

The use of external data for supervision
This section defines external data and data quality, presents disadvantages and advantages per phase, presents limitations and concludes with a table listing the relevant literature per phase.

From the point of view of a supervisor, data is 'external' when originating from sources outside the supervisory process. Consider for instance data from the Chamber of Commerce, from Dun & Bradstreet, etc. From another viewpoint, external data may refer to concepts such as big data, data sharing, data analytics and data science. Regardless the definition of the term data sharing in the EU regulation on personal data protection (Directive (EC) Nr. 95/46), this thesis uses the term data sharing for precision and specificity (Custers b & Uršič, 2016).
There are many definitions for data quality, the definition by Oliveira, Rodrigues & Henriques (2005) best aligns to this research, due to its completeness, describing its functions and criteria, both technical and practical. Data quality in terms of functionality consist of the accessibility, believability, relevancy, interpretability and objectivity. Data quality considered more technical and practical shows from missing elements, values that are missing, incorrect or invalid, misspelling, inconsistent duplicate texts, etc.

Using external data enhances all phases of the process. From the preventive viewpoint (phase nr. 1), data may enhance the understanding of risks and compliance problems: a precondition to shift from reactive supervision towards proactive prevention (van der Steen & van Erp, 2018). Additionally, data can serve as information to promote compliance (McCormick, 1998).

When predicting compliance (phase nr. 2), external data can support the timely prediction of compliance, for example by using collaborative filters (Ayres a, 2007), (Hollywood & Winkelman, 2015), to facilitate a timely response to signals and trends (Birkin, Morris, & Oldroyd, 2018). Being timely is important, consider the Covid-19 pandemic. Proactive detection of non-compliance issues include fraud, commonly supported by algorithms (a sequence of instructions). Moreover, the application of algorithms may help to signal fraudulent actions that would otherwise remain undiscovered (Brouwer & Sviták, 2018).

When preparing compliance (phase nr. 3), external data use can enhance risk-based supervision, by gaining insight into a specific risk or situation. Combined data complete the information position as the starting point for inspections, by compensating for missing data or unknown parts of (social) networks (Li, 2017), (Griffiths, 2019) and help to identify subjects that require supervision, more accurate and timely (Ayres a, 2007), (Duijn & Sloot, 2015), (Scherpenisse, Schram, & van Twist, 2017), (Brass & Veale, 2019), (Yeung 2017) via (Lodge b & Mennicken, 2019). For example, a

company can have several locations; the use of external data can direct an inspector to the appropriate address. Risk profiles can support the selection of subjects (Custers a, 2014). An algorithmic approach may address the issue of overlap or "underlap", and excessive focus on processes instead of outcomes (Hood et al. 1999; Koop & Lodge 2014; Lodge & Wegrich 2012; O'Reilly 2013) via (Lodge b & Mennicken, 2019).

When supervising to check compliance (phase nr. 4), big data can provide information to the right officer at the right time according to Ridgeway (2018) from researching police surveillance. Hence, data use supports creates a better-informed officer with a sharper focus, which increases the effectiveness of efforts (Scherpenisse, Schram, & van Twist, 2017). An algorithmic approach can limit the opportunities for gaming in response to inconsistencies in inspections (Hood et al. 1999; Koop & Lodge 2014; Lodge & Wegrich 2012; O'Reilly 2013) via (Lodge b & Mennicken, 2019). Gaming is acting creatively to achieve the desired result, such as compliance (Bal b, Grol, & Robben, 2012).

Intervening following an inspection (phase nr. 5) using external data and algorithms can promote consistency in inspectors' actions and thereby minimise arbitrary judgements (Hood. et al 1999; Koop & Lodge 2014; Lodge & Wegrich 2012; O'Reilly 2013) via (Lodge b & Mennicken, 2019).

Measuring the outcomes of supervision (phase nr. 6) is supported by de use of external data. Especially when applying tools to enhance data analysis (Ayres a, 2007). Consider the completed information position, resulting in a better comprehension the risks as the starting point.
The evaluation of supervision (phase nr. 7) benefits from the data use by supporting the substantiation of decisions made (Ayres a, 2007), (Hildebrandt, 2018), and via performance management (Ridgeway, 2018). Interestingly, research on the use of external data for supervision, shows that its benefits are mainly to the organisations' internal needs (van Aerle, Damhof, & Ouddeken, 2018), even when the topic was externally oriented (Lodge a & Wegrich, 2014).

In general, the increased completeness and availability of data, results in an increased coverage, and increased options for cross-verification for more reliable data (Ayres a, 2007). Data use may stimulate innovation (Janssen & Kuk, 2016). Multiple other effects are indirect and unquantifiable; the development of an interdisciplinary network, with access to other officials and non-traditional information, and improved intelligence, skills and capabilities of different kind (Jackson, 2014).

A limitation to external data use is the fact that it requires the sharing of data. By nature, agencies are not willing to exchange data, because of a lack of trust, mutual differences, misunderstandings and even ongoing conflicts (Fan & Qin, 2016); it requires more than data protection (security) to overcome trust issues.
Legislation may limit or prohibit the use of external data for supervisory purposes. Additionally, insight in the meaning of data and statistics is required, for the data use to be effective (Ayres a, 2007). Moreover, it is difficult for supervisors to be transparent about data models and algorithms used, when the public or court asks for transparency, from concerns about unfairness, discrimination and non-transparency (Binns & Veale, 2017). It is unsure if general information on data usage or model building can satisfy the request for transparency (Edwards & Veale, 2018).

External data usage does not exclude the possibility of missing data (Duijn & Sloot, 2015). Not in the least, before using external data, the aspect of ethics must be addressed (King & Richards, 2014). Algorithmic approaches to supervision are not always a success story (Griffiths, 2019), *the risk of* mistakes in statistical analyses is omnipresent as are the risks of data sharing. But the benefits outweigh the advantages. Moreover, the use of external data is inevitable (Ayres a, 2007). In conclusion: the use of external data enhances all phases.
The following table lists the relevant parts of the theories mentioned in this section per supervisory phase, using the numbering from the section on supervision, and will be used to construct the conceptual model.

TABLE 2

The advantages and disadvantages of applying External Data on the existing Supervision

Parts of the supervisory process		Theories
Prior to an inspection	1. Prevent non-compliance	The use of external data can help to complete data to provide more insight into structures and networks (Griffiths, 2019), (Li, 2017), into risks and compliance problems (van der Steen & van Erp, 2018), to ensure proactive detection (Brouwer & Sviták, 2018). Data can serve as information to promote compliance (McCormick, 1998).
	2. Analyse domains or risks to predict compliance	The use of external data can… - improve data quality (Lodge b & Mennicken, 2019) - provide more insight into domains and risks (Scherpenisse, Schram, & van Twist, 2017), (Veale & Brass, 2019), by composing a completer picture of the situation and networks (van der Steen & van Erp, 2018), (Duijn & Sloot, 2015), (Brouwer & Sviták, 2018), (Veale & Brass, 2019), (Li, 2017) - enhance predictions using technology, for instance collaborative filters (Ayres a, 2007) or predictive patterns (Hollywood & Winkelman, 2015), to identify subjects to supervise more accurately (Chan & Moses, 2014) for a more timely response to signals and trends (Birkin, Morris, & Oldroyd, 2018).
	3. Prepare supervisory actions	The use of external data can serve to… - signal network structures even if they cross boundaries (Bieler, et al., 2017), (Duijn & Sloot, 2015) - signal potential risks more accurate and timely (Ayres a, 2007) *by* detecting noteworthy patterns and fraud in the data (Brouwer & Sviták, 2018), (Griffiths, 2019), *and by* feeding queuing models (Mc. Ewen 2002) via (Hollywood & Winkelman, 2015) - more accurately identify companies that need supervision (Custers a, 2014), (Duijn & Sloot, 2015), (Yeung 2017) via (Lodge & Mennicken, 2019) - prevent gaming, and limit overlap or underlap (Hood et al. 1999; Koop & Lodge 2014; Lodge & Wegrich 2012; O'Reilly 2013) via (Lodge b & Mennicken, 2019).
Inspection	4. Supervise, check compliance	Data can help to… - monitor compliance and generate a sharper focus on subjects to perform more effective supervision by profiling (Custers a, 2014), (Scherpenisse, Schram, & van Twist, 2017) and better-informed inspections (Ridgeway, 2018) - prevent inconsistencies in inspections (Lodge b & Mennicken, 2019).
Post inspection	5. Intervene on compliance	The use of external data can prevent inconsistencies when intervening in response to compliance issues (Hood. et al 1999; Koop & Lodge 2014; Lodge & Wegrich 2012; O'Reilly 2013) via (Lodge b & Mennicken, 2019).
	6. Measure outcomes of supervision 7. Evaluate supervision	Data can… - support evaluation of actions and effects (Ayres a, 2007) - enhance performance management efforts (Ridgeway, 2018) - substantiate actions and decisions (Hildebrandt, 2018).

Literature review: From the general literature, not operationalised nor validated against recent developments, principles are applied to this research: Ayres (2007), Power (2004), and Sparrow (2000). Contributions with operationalisation, useful given their part on data-driven supervision, concern the material of Bieler, et al. (2017), Brass & Veale (2019), Chan & Moses (2014), and Mertens (2011). From all other materials, only substantiated, generalisable parts were used.

2.2 Evaluating the effects of supervision

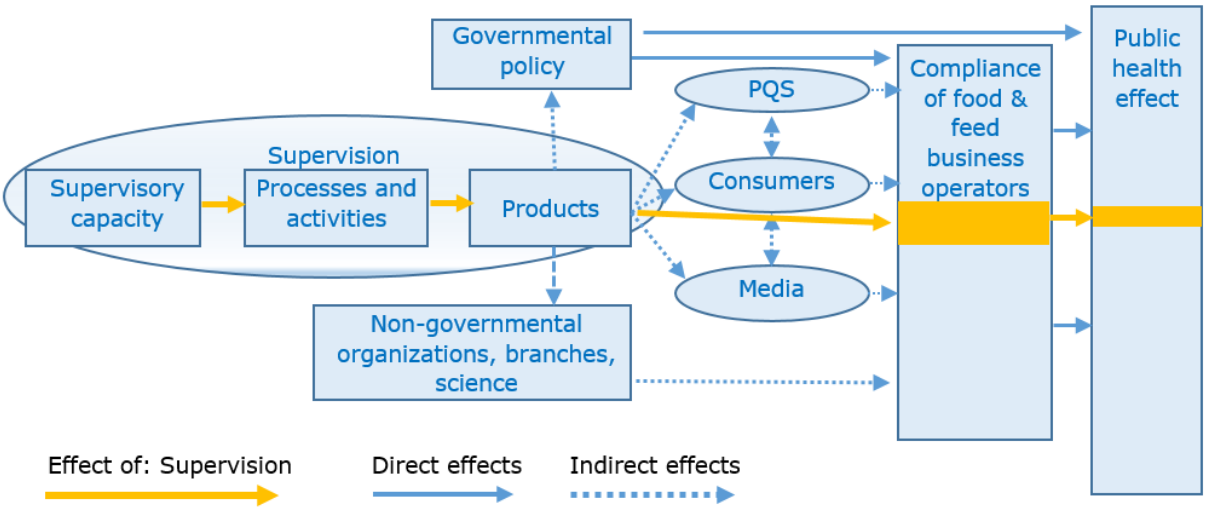
Supervision is good when it is effective and efficient (Bokhorst, et al., 2013), is not unnecessary intrusive and adheres to public values (Sorgdrager, 2019). The public values of supervision are transparency, public accountability and sufficient capacity (Sorgdrager, 2019). The term "effectiveness" can be defined as "all that is aimed for, is achieved" (Talbot, 2005), but no single definition exists (BIS, 2015).
The effect of supervision exists on three different levels, at the micro, macro and meso levels. On micro level, it is the compliance of an inspected company or a risk of a specific product. On macro level, the effect of supervision sees on a group of companies or a certain food or feed safety. At meso level, consider the food and feed safety system, or trust in that safety (Borghans & Robben, 2014).

Measuring is difficult but important, since supervision involves the commitment of resources, and should be worth its cost. Academic literature on formal evaluation is limited, partly due to an inability to determine its cause and effect (Mertens a, 2011), (van Dishoeck, et al., 2013). The available models are based on a benefit–cost ratio, such as a balanced scorecard to assess the performance of a supervisor. All models have reservations in common on the established outcomes that increases in line with the complexity of the context it is applied to, when more variables can influence the effect. Some research is operationalised, based on a model, but only cover a part of supervision, such as the inspections (Boyne, Day, & Walker, 2002), or are not generalisable to this research (de Waard & Rooijers, 1994).
Based on the simple public performance model of Talbot (2005), an impact chain was developed by van Dishoeck et al. (2013). Despite the (health care) context when developing this model, it is applicable to this research based on its substantiation and generalisability. The effect of supervision is depicted as a yellow line in the model, which shows that many variables (in)directly influence the effect of supervision. Measuring becomes more difficult as the complexity of the context increases.

Of any outcome of a measurement, such as to evaluate compliance levels, the reliability and validity should be questioned (Bokhorst, et al., 2013), especially with results from risk-based supervision, that are based on selective actions by nature (Borghans & Robben, 2014).

FIGURE 4

Impact Chain, based on the Research of van Dishoeck, et al. (2013)



From the general literature, not operationalised nor validated against recent developments, principles are used for this research. This concerns the model of Talbot (2005). Contributions with operationalisation, useful given their part on data-driven supervision, concern the material of Mertens (2011) and WRR (2013). From all other materials, only substantiated, generalisable parts were used.

2.3 Factors that determine the occurrence of effects

Effect does not occur naturally; Critical success factors (CSFs) (Daniel, 1961) can explain the success or failure of a project (Remus & Wiener, 2010). There are many definitions; essentially CSFs are all factors that induce success. CSFs target activities via characteristics, conditions and variables (Leidecker & Bruno 1984) via (Remus & Wiener, 2010). CSFs rely on their context, hence "one size fits all" approach does not apply (Remus & Wiener, 2010); CSFs should be specific enough to be useful (Globerson & Zwikael, 2006).

There are many CSFs on parts of the research question; on data integration and decision making in law enforcement (Campbell, Chantre, Edmondson, & McCollum, 2019), (Hamid, Hassan, & Mohamed, 2018), on IT governance (Alreemy, Chang, Walters, & Wills, 2016) and on supply chains (Pfoser, Schauer, & Treiblmaier, 2016). From these, all CSFs relevant to this research were collected.

The above assumes CSFs can ensure success, but conditions may prevent such. In case of external data use for supervision, legislation may hinder the emergence of success, such as purpose binding.

From the general literature, not operationalised nor validated against recent developments, the definition was applied to this research (Daniel, 1961). Contributions with operationalisation, useful given their part on data-driven supervision, concern the material of Campbell, Chantre, Edmondson, & McCollum (2019). From all the other sources, only substantiated, generalisable parts were used.

2.4 From literature findings to conceptual model

Supervision
According to the literature, we cannot do without supervision (Beck, 1992), and incidental supervision does not suffice to be effective, it should be continuous (Mertens a, 2011). Such as an annually repeated project. Therefore, supervision is modelled cyclic, consisting of the seven phases that were derived from literature (see table 1). Following, the supervisory phases are elaborated upon.

Prevention (phase nr. 1) of non-compliance sees on any action that stimulates compliance, to meet the regulatory goal. When using external data, having the one supervised, know about the external data use, to promote compliance. The prediction of compliance (phase nr. 2), defines the need for action; an informed decision when using external data. For example, when data analysis shows the supervisor that a risky product is not imported by a certain company, that predicted absence of a compliance issue, substantiates not acting for this risk, towards this subject.
The preparation of actions (phase nr. 3) must ensure an optimally performed supervision; the most effective and least intrusive manner. For example, consider a phone call to a company to request a copy of a specific document, based on a data analysis outcome, versus visiting a company and interview to establish if the risk sought is relevant to that company, and subsequently perform an administrative check on related documents. Or even not planning an inspection if the risk sought does not occur at a company.
Performing supervision to detect compliance (phase nr. 4) is not limited to physical inspections; external data can help to (partly) replace these by administrative– or other efforts. Promoting compliance and punishing non-compliance are interventions (phase nr. 5) in response to findings. Using external data can serve for consistency in interventions, by ensuring similar interventions for comparable cases. Measuring the outcomes of supervision (phase nr. 6), when using external data, is based on a more robust data, a completer picture of the domain or risk. This can outcomes of a measurement more reliable and valid.
Evaluation (phase nr. 7) that follows inspections and interventions can target performance management as well as other aspects, such as compliance levels. Using external data can make an evaluation more useful and trustworthy, when it is based on a completed picture of the risk or domain.
The following figure presents supervision as a cycle, with the seven parts, described in this section.

FIGURE 5

The Parts of the Process that constitute to Supervision

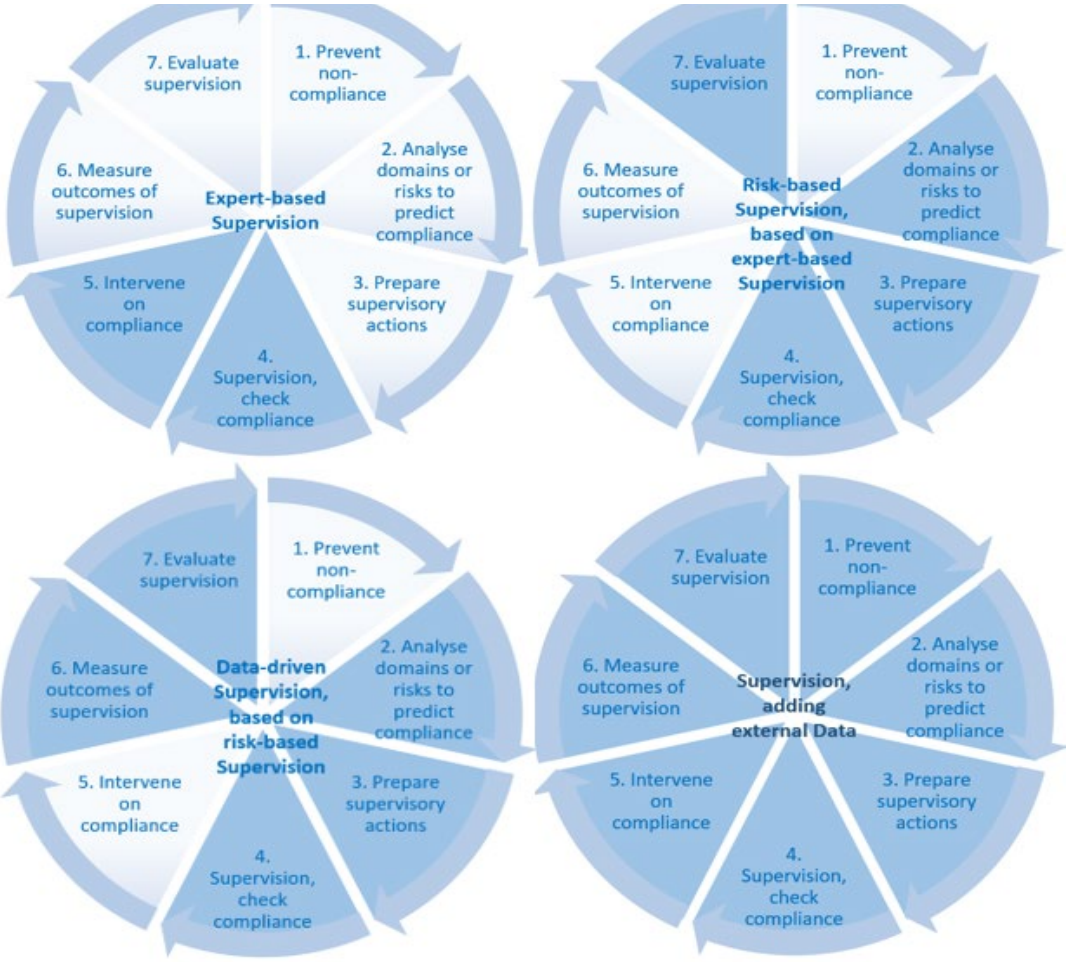
Supervision, expert-based, risk-based and data-driven, using external data

Based on the findings per type of supervision (see § 2.1), the emphasis is on different supervisory phases. Since every type builds upon the previous one, each type adds something. With expert-based supervision, the emphasis is on performing supervision (4) and interventions (5). Risk-based supervision, additionally focusses on analysis (2) and evaluation (7). Data-driven supervision additionally supports measuring outcomes (6), external data use enhances every phase.

The following figure, presenting the types of supervision, visualises the emphasis on phases per type.

FIGURE 6

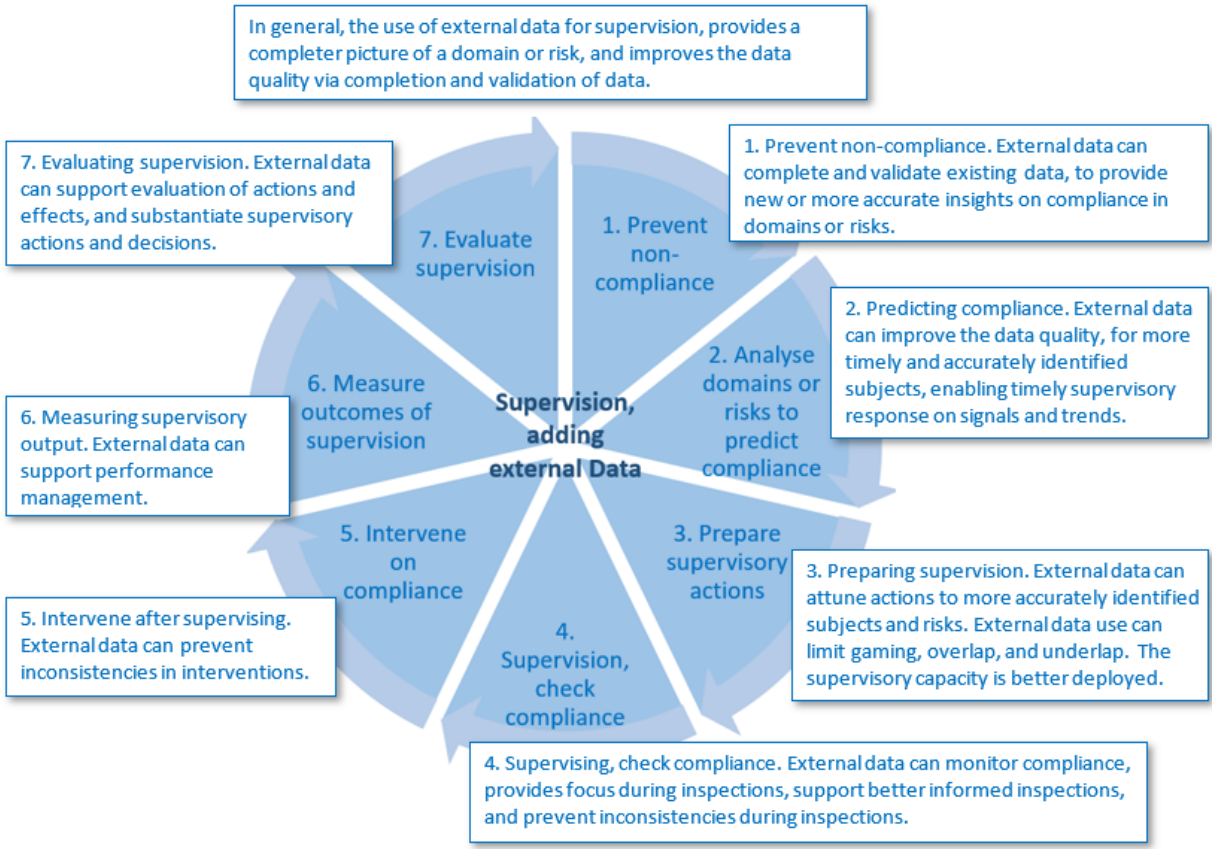
Emphasis per type of Supervision on Parts of the Supervisory Process



To evaluate the effects when using external data for supervision, a conceptual model with seven phases is created, based on the literature findings as presented in table 2, and using the effects the impact model presents; effectiveness, efficiency, intrusiveness and adherence to public values. The conceptual model will be operationalised in § 2.5.

FIGURE 6

Conceptual model of this Research



Critical Success Factors

Literature shows that external data, such as big data, can affect supervision; hence, conditions and limitations apply. The use of external data appears to depend on the context of the situation. Thus, empirical research in this research will focus on applying external data from another supervisor to affect the supervision studied.

Because of the number of CSFs, their factors were categorised in random order: human performance, strategic, organisational, operational, IT, data, finance, legal and external. Based on literature, the categories and the factors these present, cannot be differentiated or scaled, to their importance to the use of external data. Nor did literature provide insight on whether or how these can be achieved in practice; what their feasibility is. The following listing presents all factors, per category.

Factors per category

External	Society (e.g. protection, food safety), economy
Strategic – external	Environment (politics, ministry), strategic alignment, organizational structure, stakeholder management- including other supervisors
Strategic – internal	Governance: management support, implementation, internal controls, financial support, stakeholder management, legal compliance (AVG)
Operational	Capacity, performance management (efficiency and effectiveness), intelligence, facilitation, security management
Human performance	Trust. Leadership, communication, performance management, culture.
Information Technology	IT architecture and infrastructure, capacity, process design, reliability and recovery, security

Data	Availability, quality, usefulness, security

2.5 Operationalisation of the conceptual model

To validate the theory the conceptual model aims to build, by testing it using practical data, a part of the model is operationalised, the three phases where external data have direct influence, by serving as input. The operationalisation is presented per phase, starting with compliance prediction (2), followed by preparing supervisory actions (3), concluding with checking compliance (4).

Supervisory phase 2: Predict compliance

On phase 2, the conceptual model states: "external data can improve the data quality, for more timely and accurately identified subjects, enabling timely supervisory response on signals and trends."

The elements of data quality improvement, more timely and accurately identified subjects, and enabling supervisory response, will be elaborated upon in this section.

Data quality improvement

In this research, data serve as evidence on regulatory compliance. From data quality, the availability and accessibility are important: can data be exchanged with supervisors, are the data objective, and is the access to evidence, restricted and secured to prevent data from manipulation. If so, does it positively affect the supervision, for instance by providing evidence that meets the legal demands, is more trustworthy, and meanwhile not compromises the supervisions' effectiveness or efficiency.

Data quality in practical sense, emphasises on compensating missing elements and -values to solve blind spots; adding external data can make the supervisors own data, completer and more robust. To de measured in the context of this research by whether issued data requests did result in the availability of data, by the securing of data; whom has access. The data quality is to be measured via the detection of formerly unknown subjects (i.e. companies, consignments or risks) that indicate solved blind spots, and by imputation of missing values, that served to enhance compliance prediction.

Hereafter, for readability, completed and – robust data of an improved quality are referred to as better data.

More timely and accurately identified subjects

Compliance prediction serves to gain insight into domains and risks. Data help determine what the most significant risks are, where supervision should be directed by identifying subjects that require supervision. Even though at least some are worth addressing (Power, 2004), (Beck, 1992), subjects or risks that 'require supervision' are not defined. For this research, these are defined as subjects (companies, products) that pose the most significant risks to the society (Sparrow, 2000).

External data, when making a supervisors data better, can make de identification more accurately and more timely, may even generate insight in networks. As a result, actions to check compliances can be limited to the sharply identified subjects, to achieve the objective of the supervision. Or actions may be possible, that would have been impossible without external data use. Preventing unnecessary actions or facilitating targeted actions is not only more effective and efficient to the supervisor, it is also less intrusive to companies. Timely identifying subjects can make supervision more effective, when it results in not missing out in chances to establish non-compliance. Acting just in time, and meanwhile preventing unnecessary inspections, can legitimise (the use of external data for) the supervision, consequently contribute to the supervisors public values.

This is to be measured via prevented unnecessary inspections, enabled actions that are impossible without external data, and by (timely) detected non-compliances that would have remained unseen, without the use of external data.

Hereafter, for readability, more timely and accurately identified subjects will be referred to as better-identified subjects.

Supervisory response on signals and trends

In the context of this research, predicted compliance induces a response from the supervisor. External data can serve to respond more timely and more accurately, when based on more robust and compete. Hence, enable not missing out on any relevant leads or occasions to control a risk. Making supervision more effective, when problems are noticed and dealt with in time.

To be measured by not missing out on signals by being too late to supervise upon them, and the detection of signals and trends that otherwise would have remained unseen, shown from formerly unknown subjects to supervised upon, when using external data.

Summarising, the practical data should be analysed, for the prediction of compliance on;
data quality improvement: the availability of - and access to external data (1), the occurrence of imputation (2), detection of formerly unknown subjects (3)
subject identification: prevented unnecessary inspections (4), enabled actions that are impossible without external data (5), timely detected non-compliances, only seen because external data were used (6)
response: signals that were not missed out on or timely responded to, due to external data use (7), and subjects to supervise upon, unknown without the use of external data (3).

Supervisory phase 3: Prepare supervision
On phase 3, the conceptual model states: "external data can serve to attune actions to more accurately identified subjects and risks. External data use can limit gaming, overlap, and underlap. The supervisory capacity is better-deployed."
The elements of attuned actions, more accurately identified subjects, gaming, overlap and underlap, and better-deployed capacity will be elaborated upon in this section.

Attuned supervisory actions
Attuned supervisory actions to prepare supervision, are not defined in literature. Adding focus by using risk indicators can make supervision more consistent and consequent, (Borghans & Robben, 2014), and adjusting supervision to best meet the supervisory objective, makes supervision proportionate to the risks targeted (Mertens c, Scherpenisse, & van der Steen, 2014).
Thus, for this research, attuned supervision is defined as actions that are adjusted to the risk targeted, proportionate and as unobtrusive as possible while effectively addressing the risk sought: it is 'tailored' to the risk, capacity and burden. Consider preparing supervision using external data, that proves a telephone call suffices to establish compliance, versus the planning of a general inspection visit, that starts without the head start that external data use establishes.
From the viewpoint of responsiveness, the leeway for autonomy to the one supervised, could be found in attuned actions. For example, when the supervisor decides not to inspect a company, based on the companies' ability to control risks, rather pass on risk assessment information. After informing about the risk (McCormick, 1998) to promote compliance, the inspector can focus on how the information was effected. Leaving the responsibility for compliance, at the company.
To be measured by the variation in actions, and the effect of tailored actions.
Hereafter, for readability, supervision adjusted to effectively and efficiently address the risk it targets, is referred to as attuned supervision.

More accurately identified subjects – viewpoint of preparing supervision
Better identified subjects, in relation to compliance prediction, are identified more timely and accurately. In relation to preparing supervision, the accuracy is relevant; planning a visit to the appropriate location, that is sharply identified. This part is not exactly the same but will be measured in the similar way, via the number of prevented unnecessary inspections, and by detected non-compliances that would have remained unseen, without the use of external data.
Moreover, in the context of this research, better-identified subjects can be considered as every subject having an equal chance to be supervised upon, what requires every subject to be known when preparing actions.
To be measured by the detection of formerly unknown subjects, due to the use of external data.

Limited gaming, overlap and underlap
Gaming is defined gaming as acting creatively to achieve the desired result (Bal b, Grol, & Robben, 2012), consider presenting documents to an inspector, that suggest compliance. Overlap is defined as a too high inspection frequency, underlap as "missing inspections" (Lodge b & Mennicken, 2019), for instance when not covering all subjects that require supervision (Helsloot & Scholtens, 2014), (Honingh & de Wolf, 2014). Notably, unnecessary inspections are not equal to overlap. Overlap can be explained as visiting the same subject twice, for different reasons, and both may reduce the risk

sought. While unnecessary inspections, regardless the reason, do not contribute to risk reduction (Mertens a, 2011).
When the preparation is a joint action, rather than have two supervisors perform the same process to identify their own subjects, on process is performed jointly. This can further prevent overlap and underlap but requires a joint data foundation.
The effect of external data use on the preparation of supervision is to be measured via detected occurrence of gaming, efforts that do not contribute to risk reduction, inspection frequencies, via formerly unknown subjects and whether subjects are selected via a joint effort.

Better deploying supervisory capacity
Deploying supervisory capacity is not defined in the literature. Based on Mertens' definition (2011) of supervision, it is defined as all resources available to perform supervision.
Risk analysis can facilitate proportionate and effective supervision (Mertens c, Scherpenisse, & van der Steen, 2014), the use of risk indicators can add focus (Borghans & Robben, 2014). To address risks more effective and more efficient.
Moreover, timely performed supervision can prevent a problem to increase. Consider acting upon the cause instead of also solving a subsequent crisis; for instance deal with all supermarkets whom sell contaminated food, opposed to dealing with the one production facility that caused the problem. Moreover, an inspection to the production facility can be planned more efficiently than the actions needed to solve an immediate problem. To be measured by the capacity used to address a risk, and the planning of capacity.

Summarising, the practical data should be analysed, for the preparation of supervision on;
attuned supervisory actions: the variation in actions (1), the effect of tailored actions (2)
subject identification: prevented unnecessary inspections (3), detected non-compliances, only seen because external data were used (4), the detection of formerly unknown subjects (5)
gaming, overlap and underlap: detected occurrence of gaming (6), efforts that do not contribute to risk reduction (7), inspection frequencies (8), formerly unknown subjects (5) and whether subjects are selected via a joint effort (9)
deployed capacity: the capacity used to address a risk (10), and the planning of capacity (11).

<u>Supervisory phase 4: Perform supervision to check compliance</u>
On phase 4, the conceptual model states: "external data, can monitor compliance, provides focus during inspections, support better-informed inspections, and prevents inconsistencies during inspections."
The elements of monitor compliance, focus during inspections, better-informed inspections, and the prevention of inconsistencies during inspections, will be elaborated upon in this section.

Monitor compliance
In the context of this research, actions aim to address a risk, external data can serve to improve the monitoring. For instance by replacing an inspection visit to a company with a data analysis that is less time consuming and does not require a visit. This implies a more effective and efficient performance of the supervisor that is less intrusive to the one supervised.
To be measured via the extent to which the use of external data replaced other efforts, to achieve the goal of the supervision.

Focus during inspections
Inspections aim to check compliance in the context of this research. Whether external data can facilitate to focus during an inspection, to increase the chance of detecting non-compliance if there is. The use of external data, when they provide focus, can facilitate and improve the detection. Focus ensures finding the problem the preparation foresees; seeking for the right evidence. To distinct being focussed from being informed; focus refers to specific information, informed refers to more information.
Hence, focus when supervising is seeking for specific information to detect compliance. To be measured by the success of efforts when using external data, success as detection of risks sought, that would not be found without the use of external data, or would have taken more time to find.

Better informed inspections
Being informed when supervising, refers to having more information. But a clear definition is lacking, the literature explains better-informed inspections by a better-informed inspector whom is offered (push) more information on the subject (Ridgeway, 2018), in contradiction to an inspector having to seek for information (pull). Moreover, the inspector may not find time to seek information when the supervision demands a rapid response.
When external data can offer an inspector more information prior to the action, this can affect the action supervision and its outcomes. To be measured via the preparation of inspections; was more information offered prior to the inspection, with the help of external data, and did this make a difference. The practical data will be analysed on the preparation of supervision, in terms of information to the inspector.

The prevention of inconsistencies during inspections
When performing supervision, acting consistent is important. Literature relates consistency to the use of algorithms, supporting uniform acting (Hood et al 1999; Koop & Lodge 2014; Lodge & Wegrich 2012; O'Reilly 2013) via (Lodge b & Mennicken, 2019). As opposed to Responsive Regulation that states leaving room for responsiveness to ensure actions serve the objective of compliance best (Ayres b & Braithwaite, 1992). Thus, consistent supervision is defined as have inspectors acting as uniform as possible, even though circumstances are not exactly similar. This acting may be in the approach or in the response to findings, that is enhanced when using external data.
To be measured by the way inspections are performed in terms of uniformity, and the response on findings in terms of interventions, by seeking trends or patterns that might indicate inconsistency.

Summarising, the practical data should be analysed, for supervising to detect compliance, on;
monitor compliance: the extent to which data use replaced other efforts (1)
focus: success in detecting compliance, with less efforts (2)
better informed inspections: the information offered prior to actions (3), and the effect of the information offered (4)
prevention of inconsistencies: uniformity in inspections (5), response on findings (6).

Summary of Chapter 2
Literature defines supervision as acts to establish compliance with the regulations, and is essential in any legal system to ensure the regulatory goals met, to mitigate societal risks. Effective supervision is responsive, embraces tripartism, and promotes compliance. Efficient supervision spends its capacity selectively, prioritizing the most significant risks, based on risk management.
External data use ensures continuity and enhances all phases of the supervision.
External data use provides insight into domains and risks, improving data, predictions, and subject identification. Gaming, overlap and underlap are limited, while actions are better-informed and tailored, interventions more consistent. Reports and evaluations improve, actions and decisions can be substantiated. Efficiency and outcomes of supervision measurement is challenging, causality difficult to claim, and outcomes must be questioned, with (selective) risk-based supervision. Factors can explain but cannot guarantee the success of supervisory effects; conditions, such as legislation, may prevent this from happening.

3. Research Methodology

This chapter presents the research design, data collection and -analysis. To explain how data are used, to investigate if effects obtained from the literature, can be substantiated with practical data.

3.1 The research design

The literature on the use of external data for supervision on internationally traded goods, is limited. According to Boeije (2010), by nature, exploratory research raises questions for analysis that suits this research's aim: to gain knowledge in a field of interest that has not been extensively studied. The use of external data, being supervisory data, for the purpose of supervision is not previously studied and there is a need for knowledge: this research calls for exploratory research.

Qualitative research describes a methodology that explains to gain understanding on a topic, to contribute to theoretical knowledge and practical use according to Corley, Gioia, Kreiner and Rheinhardt (2018). In this research, the three conditions of a qualitative research according to Yin (2018) are met. The underlying research questions are of an explanatory nature (1), the investigator has no control over the studied effects (2) since they are based on historical data, and the research focuses on a noncontemporary phenomenon (3) as the obligation to perform the described controls (OCR, article 44(1)) is not finite. Thus, this research qualifies for qualitative research.

3.2 Planned data collection

To establish if findings from practice can confirm the theory presented by the conceptual model, purposive sampling selected the supervisory phases that are directly influenced by the data, to be operationalised (see § 2.5). These parts are compliance prediction (phase nr. 2), preparing supervision (phase nr. 3), and supervise, to detect compliance (phase nr. 4). The data collection embodies a multiple-case study on historic data requests, interviews, a survey and a single-case study on non-aligned EU regulations, structured as table 3 presents. From these, the data on historic data requests from 2017, 2018 and 2019, are key. Methods are motivated and elaborated upon, following table 3.

TABLE 3

Thesis Structure

Chapter	Deliverables	Research question	Research Method
1: Introduction	Introduction, problem statement, environment		Desk study, preliminary interview
2: Literature review	Knowledge base	Sub-question 1, 2, 3	Literature study
3: Methodology	Methods		Desk- and literature study
4: Results, Discussion	Results, limitations	Sub-question 4, 5	Data requests, input from expert interviews. Stakeholder interviews. Survey on success factors. Case study on non-aligned EU regulations.
5: Conclusions, Contributions, limitation and Recommendations	Conclusions, knowledge and practical contribution	Main research question	

Historic data requests
First, all historic data requests in the period studied, will be inventoried by questioning experts for any emails on requests. After verification and validation of the inventory by the experts, data will be collected by a series of interviews on six aspects per request, in line with the sequence of steps in the process: (1) the purpose of the data request and its context, (2) the data requested in used

sources and - risk indicators, (3) the problems when retrieving data, (4) the data analysis by the NVWA, (5) the application of retrieved data, and (6) the effect of the data on the supervision. Data from the interviews are reported and presented for validation to the expert. Data on the requests, are collected and stored per case.

This research uses interviews; this method facilitates gaining in-depth knowledge since it offers the opportunity to raise additional or follow-up questions if needed to understand the interviewees' meaning of answers. Unlike with surveys, answers are not limited and the burden of writing is on the researcher (Furgerson & Jacob, 2012). The motivation for a case-study is in the aim of the study; to gain cocrete, in-depth knowledge about a specific subject, in the real-word context it is part of. To study both characteristics and effects, while maintaining of focus is facilitated by the method.
The selection of multiple cases facilitates a cross-case analysis, and serves to investigate different aspects (Asimiran & Nije, 2014), (Frohlich, Tsikriktsis, & Voss, 2002), (Gibbert, Ruigrok, & Wicki, 2008), (Yin, 2018). Historical data are used; these cannot be influenced by the attention a research, by nature, draws.

Coding requests on multiple aspects enables the cross-case analysis, to discover relationships or patterns. For confidentiality, the data is presented anonymized, all data are available at the researcher. For the coding of the data request purpose (1), the categories are, in line with the supervisory phases of the conceptual model; (1.1) prevent non-compliance, (1.2) predict compliance, (1.3) prepare supervision, (1.4) supervise, (1.5) promote compliance or punish non-compliance, (1.6) measure effects, and (1.7) evaluate supervisory efforts.
Coding the sources (2) of the requested data, in alphabetical order; (2.1) AGS-i, (2.2) AGS-u, (2.3) DMF, (2.4) ECS, (2.5) GPA, (2.6) NTCTS, and (2.7) Venue. Coding the risk indicators used (2), in alphabetical order; (2.10) information on companies, including addresses, (2.11) product information, including goods description and CN code, (2.12) shipping details, e.g. a container number, (2.13) specific details, for example Customs references, and (2.14) supply chain information, including country of origin or - consignment.
Coding the problems the NVWA experiences when retrieving data (3), in chronical order: (3.1) organisational, including the facilitation of data requests, (3.2) executable request, including the identification of companies or products and the quality of the request, (3.3) availability of data, including the time it costs for a Customs system to build historic data, and (3.4) availability of data processing capacity. Coding the data analysis by the NVWA (4), in alphabetical order; (4.1) algorithms applied, and (4.2) other means of data analysis.
Coding the application of the retrieved data (5), in random order: (5.1) as planned, missing information was retrieved, or (5.2) not as planned, no data retrieved that could fulfil the request.
Coding the consequence of the data on the supervision (6), in random order; (6.1) no longer an inspection needed to establish compliance, case closed, (6.2) attuned supervision that is more targeted to the problem, (6.3) supervision, such as an inspection is enabled that would not have been possible without the data use, (6.4) replace supervision, (6.5) information need fulfilled, and (6.6) for requests where the retrieved data did not meet the goal. Coding the effects of the data use (7), in random order; (7.1) companies were identified, (7.2) products were identified, (7.11) a formerly unknown company was found, (7.21) official controls were respected, (7.31) problem solving was prevented, as a consequence of intervening timely upon problems, and (7.41) external data used facilitated a better-planned efforts.
The following table presents all codes that will be used to categorise the collected data.

TABLE 4

Overview of Codes to categorise the Aspects of the historic data Requests

Aspect	Code and description
Purpose of the request (1.1 - 1.7)	1.1 Prevent non-compliance, 1.2 Predict compliance, 1.3 Prepare supervision, 1.4 Supervise, detect compliance, 1.5 Promote compliance or punish non-compliance, 1.6 Measure effects, 1.7 Evaluate
Data requested (2.1 - 2.7)	2.1 AGS-i, 2.2 AGS-u, 2.3 DMF, 2.4 ECS, 2.5 GPA, 2.6 NTCTS, 2.7 Venue

Risk indicators (2.10-2.14)	2.10 information on companies, 2.11 product information, 2.12 shipping details, 2.13 specific details, 2.14 supply chain information
Problems (3.1 - 3.4)	3.1 organisational, 3.2 executable, 3.3 availabililty, 3.4 capacity
Data analysis NVWA (4.2, 4.2)	4.1 algorithms applied, 4.2 other analysis
Application of retrieved data (5.1, 5.2)	5.1 as planned, missing information was retrieved, 5.2 not as planned, no data retrieved that could fulfil the request
Effects on follow up (6.1-6.6)	6.1 an inspection is no longer needed to establish compliance, 6.2 attuned supervision, 6.3 supervision enabled, 6.4 replace supervision, 6.5 information need fulfilled, 6.6 data did not meet the goal
Effect: findings (7.1-7.2, 7.11, 7.21, 7.31, 7.41)	7.1 company identified, 7.2 product identified, 7.11 company formerly unknown, found, 7.21 official controls respected, 7.31 problem solving prevented, 7.41 better planning possible

Interviews

Two types of interviews were held. One series of expert interviews to obtain data on historic data requests. Another series of stakeholder interviews, focus on the process. For the completeness of the interviewee selection, stakeholders will be obtained from the research framework (Annex 1) and mapped (Freeman, Harrison, & Wicks, 2007). All directly involved stakeholders will be interviewed, others based on their relevance to the research. Interviewing all inspectors whom perform monitoring individually, costs too much capacity; they will be requested to share their experience in a group setting during a team meeting.

The motivation to apply interviews is described in the previous section; the method facilitates the knowledge contribution this research aims for in the best way (Furgerson & Jacob, 2012). Interviews are semi-structured by nature, with a few issues, and a few open and expansive questions per issue, enabling answers to head in multiple directions, to align with the nature of the research, and to limit the researcher's influence. Interviews will rely on a predetermined protocol, presented on forehand. Every protocol will include an introduction to the research, to enable interviewees to preview and discuss unclear questions at the start of the interview. The protocol includes instructions, for example on the validation, so that no aspect will be forgotten. Interviews will be scheduled, allowing time for additional questions to further elaborate upon unexpected responses that might be useful to the research. During interviews, notes will be taken. Interviews will be recorded, if agreed upon. After the interview, the transcript will be submitted to check for correctness and completeness. Transcript are written in- or translated into English by the researcher. After processing comments, transcripts are resubmitted for validation. After validation, any audio recordings will be erased. Only validated transcripts will serve as input for this research.

Survey

A survey will be held to investigate factors, relevant to the use of external data, at category level. This method supports data collection on multiple aspects at once, from a group, the "NVWA Douane Netwerk", presenting all NVWA with comprehension of the research topic. This research will be introduced during a network meeting, to ensure the survey and its aim is understood, prior to its distribution. Moreover, to anticipate on the reported commonly low response rate of surveys, and the lack of a chance to raise additional questions in case of unclear answers (Anderson, Rossi, & Wright, 2013). The survey contains open questions to describe the perceived importance and feasibility and in addition, and a request to value the categories to enable comparing categories with each other. To validate the survey outcome, management will be interviewed, using a predetermined semi-structured protocol. Data on the level of factors rather than categories, will be obtained from the stakeholder interviews.

Case study

To investigate the effects of non-aligned EU legislation, via goods identification, a version of the EU feed additive register will be translated into CN codes by the researcher. To validate the translation,

Customs experts from the Customs department specialised in classification, "Binding Tariff Information" (BTI) will check a purposive sample. The appropriate sample size is calculated on forehand, using a confidence level of 95% and the most commonly used margin error of 5%, to ensure certainty on the findings. The applied statistical power of 80% must prevent erroneously accepting that the translation is correct (Field, 2018), thus ensure that the findings are acceptable and useful for this research. The sample selection via purposive sampling will be performed by the NVWA's coordinating specialist on feed safety to avoid sample bias from the researcher.

The motivation for a case-study is the aim of the study, as previously explained; to gain concrete, in-depth knowledge about a specific subject, in the real-word context it is part of. The selection of a single-cases, is based on the depth of the analysis on a single phenomenon (Asimiran & Nije, 2014), (Frohlich, Tsikriktsis, & Voss, 2002), (Gibbert, Ruigrok, & Wicki, 2008), (Yin, 2018).

The following table presents an overview of all types of data, and the methods used to collect these data.

TABLE 5

Overview of intended Data Collection

Data collection	Purpose
A series of expert interviews	For a multiple-case study on historic data requests, from the NVWA officer responsible for monitoring at tactical level during the period studied. Input for sub-research question four and five.
A series of stakeholder interviews	For input about the process from all directly involved stakeholders on the process, from the viewpoint of the main research question. The interviewee selection based on stakeholder mapping, for completeness. Inspectors will be interviewed group-wise. Input for sub-research question four and five.
A survey amongst NVWA experts	Input from the "NVWA Douane Netwerk" members to identify and scale factors that determine success, using Customs data for NVWA supervision, on their importance and feasibility. Input for sub-research question four.
EU register of feed additives and the HS	For a single-case study to investigate the effects of non-aligned EU regulations, via goods identification in divergent EU legislation. Input for the part on problems of sub-research question four.

3.3 Data sampling and analyses

In the following section, the data collection is presented, including deviations from the planned data collecting and analysis, in the order of the previous paragraph. In general, the thesis planning (RSM, 2019) was amended due to COVID-19 crisis.

Executed literature review
The predefined terms to search for literature were not successful. The search restarted using the name of an influential researcher on regulation, Prof. Julia Black (2008). Her publications provided names of other influential researchers, starting with R. Baldwin whom wrote "Really responsive regulation" (2008), and contributed to the "Oxford Handbook of Regulation" (2010). The search continued via other influential researchers, as presented in Annex 3. Moreover, the search scope was not limited to food and feed safety given the limited availability of relevant academic literature, but expanded to education, finance and healthcare.

Data collection on historic data requests
Via multiple interviews, data were collected on the historic data requests in the years 2017, 2018 and 2019. The interviewee is a NVWA officer, responsible for monitoring at tactical level during the period studied. During five interviews the data on all requests were collected, these were held on December 16th 2019, January 30th, February 5th, February 10th, and February 13th 2020.

There have been 34 requests in 2017, 2018 and 2019. From these, two requests were out of scope since they did not target the use of Customs data for the supervision (nr. 5, 13). Eight requests (nr. 22, 26-30, 32, 33) were not completed in April 2020; the data sets have not been supplied. These ten non-completed and out of scope requests, were excluded from the dataset. The research continues with the 24 finalised and relevant data requests (nr. 1-4, 6-12, 14-21, 23-25, 31, 34).

Ten requests aimed to predict compliance (purpose code 1.2); to gain insight on imports of a company (i.e. nr. 4), to learn if a risky product was imported (i.e. nr. 7), to learn if an importer actually stopped importing risky products as stated in response to earlier non-compliance (nr. 3), and to respond on a signal stating fraud was committed (nr. 34) that could not be verified without the use of Customs data. Nine other requests aimed to prepare the supervision (purpose code 1.3). To prepare sufficient capacity for a certain risk (nr. 2), and to learn specifics on a consignment, as a lead for attuned supervision (nr. 10, 11), and to gain insight on the supply chain, to prepare for signalling future consignments subject to monitoring (nr. 15, 16, 19, 21, 31), and to complete the NVWA's register of feed business operators, solving this blind spot must ensure that the subject selection for risk-based supervision is based on a complete register (nr. 20): no companies should remain "unseen" by the supervisor. Three requests aimed to supervise (purpose code 1.4). Rather than inspecting a company or consignment, Customs data on a subject are analysed to establish compliance (nr. 18), and to replace a physical inspection on the consignment (nr. 24, 25).
Two requests aimed to evaluate the findings (purpose code 1.7); on request of the EU Commission whom applies Pre Mission Questionnaires to prepare their audits to EU Member States (nr. 6, 12).

TABLE 6
Overview of 24 completed, relevant data Requests in 2017, 2018, 2019

Nr	Anonimized subject
1	Following an inspection, verify that a certain high risk food product from Nigeria is not imported, there is a risk of contamination with pesticide residues. The data detected no consignments that meet the criteria, the company is considered complaint based on these data. Rather than inspecting the administration of the company, the Customs data provided answers. Official controls were respected, good did not surpass the official controls.
2	Establish required capacity (inspectors, laboratory) in response to amended EU legislation, for controls on a product from Argentina, based on supply chain insight. The number of imported consignments from the Customs data served to calculate the impact of inspections on the capacity of both inspectors and laboratory, to facilitate the planning of resources.
3	Following an inspection, verify that a certain high risk food product is no longer imported. Rather than inspecting and searching administration of this company, the Customs data showed no leads to substantiate such an inspection, no non-compliance showed.
4	Prepare for supervision by gaining insight on a company's status: an importer yes/ no. Multiple consignments demonstrate the company is an importer too. Rather than investigating the companies administration, a highly time consuming activity, the Customs data can serve to focus during the inspection. No non-compliance showed on the obligated official controls based on the data match.
6	Pre mission questionnaire (PMQ) on Food Contact Materials (FCMs). Data were collected an reported. Scope of FCMs is found to be extensive during the exercise to translate data requested via product descriptions into CN codes. Supply Chain insight was obtained, the cleaned data show in 2015 and 2016 an average of 56 imported container loads (20") daily, from which 75% passes on to other EU Member States.
7	RIF notification on a FCM product from India; establish the relevance to the Netherlands. All consignments from the Indian exporter were screened within one working day. One Dutch importer was not known by the NVWA from its import activities. Rather than spending a general inspection at this importer, a very targeted visit was planned, using references from Customs data to target specific consignments from the notification.
8	Following an inspection, verify that a certain product from Ghana is not imported. Non mandatory customs information, combined with NVWA data, reveals compliance towards this risk. All consignments from one year were analysed based on Customs data. No non-compliances showed on short notice, with a simple data analysis. To achieve the same data and findings from an inspection, would have costed a highly frustrating and time consuming inspection.
9	Prepare for supervision by gaining insight on a company's status; an importer yes/ no. A discrepancy between KvK and EORI numbers hinders a smooth data request. Next inspection visit will be targeted towards a select number of specific products, that raise questions based on the Customs data, not necessarily non-compliance but risks though.
10	RIF notification on a food product from Serbia; establish the relevance to the Netherlands. Customs data show the details sought to inspect, and evidence to block the goods: the consignee, details on the transport and customs status of the goods. A timely response (inspection planned) prevented problem solving afterwards. All obligated controls were properly and favourably addressed.

11	Customs signals a container with toxic gas in the headspace; obtain details to enable supervision. The addressee was detected in Customs data. Goods appeared within the supervisory scope of the NVWA. Expert judgment of chemical NVWA engineer resulted in no further actions; the risk sought is absent. Rather than stopping a consignment in the port and opening a container that holds toxic gas, data analysis replaced an inspection. A timely planned response prevented problem solving afterwards.
12	PMQ on insects uses for animal nutrition. Data were collected, cleaned and reported. Additional insights gained induced further administrative searching in NVWA data on 10 consignments; the goods description was not clear enough. The further search established compliance of all consignments at once, saving inspectors a physical inspection to sort this out.
14	Verify a tip on a feed product from Russia: establish the relevance to the Netherlands, preferably not by inspection. Customs data could not confirm the tip. Eight alternative consignments could be related to the producer and buyer, but had no Dutch interference. Data prevented inspections.
15	Prepare for risk-based supervision by gaining supply chain insight on certain feed products. On these products, the NVWA lacked supply chain insight; volumes, frequencies, stakeholders, modality. this knowledge is provided for by these data. Enabling the signaling of future consignments to monitor, on a scale appropriate to the risk targeted, planned in advance.
16	Verify a tip on a biologic food/ feed product, to attune further supervisory actions. volumes and frequency of imports shows from the Customs data. The information is not detailed enough to answer this question accurately: an attuned inspection is scheduled to investigate specific documents. Such a targeted visit saves supervisory capacity (efficiency), is less intrusive to the company, and results in the same effect; establishing compliance.
17	Verify a signal on a feed product from the United States; establish relevance to the Netherlands. The imports were investigated, no consignments were detected in the dataset. Rather than having inspectors search for these goods at different places, Customs data provided the insight that searching would not result in finding the product sought. This small scale data analysis, saved unnecessary inspections and prevented a supervisory burden on trade.
18	Verify a tip on potential non-compliance with a feed product from Pakistan. Tip offers details that serve as leads for searching. Customs data were very useful, insight in all consignments that might suit the tip, was gained. Meanwhile, unknown companies were detected. Additional information on the tip offered more leads, but none could confirm the tip. The thorough searching was not possible in any other way. The seriousness of the risk substantiated spending capacity.
19	Prepare for risk-based supervision by gaining supply chain insight on certain feed products. Customs data revealed importers of the product, and supply chain knowledge; volumes, frequencies, stakeholders. Attuned inspections were scheduled, in order of decreasing imported volume. Formerly unknown internal (NVWA) underlap was detected.
20	Prepare for risk-based supervision by gaining supply chain insight on certain feed products. Insight gained on goods, volumes and frequencies. goods descriptions, packaging, countries of origin and destination. Companies formerly unknown to the NVWA were detected that should have been registered.
21	Prepare for risk-based supervision by gaining supply chain insight on feed additives. data were provided but not useful for their purpose.
23	Replace physical inspections by demonstrating that channelling of PAP Export consignments in practice is achieved in 2018, based on Customs data. Insight on the supply chain, channelling demonstrated, method useful to replace simple physical inspections, 8,153 annually in the port of Rotterdam – at least requiring 2 full time inspectors. Imputation of lacking data element (container number) possible, based on a combination of other elements; MRN number, date, company details.
24	Replace physical inspections by demonstrating channelling, completing request nr. 23. Mission accomplished, exit of the last three consignments is demonstrated; channelling demonstrated.
25	On request of the EU audit service, demonstrate channelling on consignments, verify exit. Rather than detecting during a physical inspection at the point of EU exit, administrative proof on channeling. Drastically limiting the supervisory burden and still adhering to the goal of the EU legislation.
31	Prepare for risk-based supervision by gaining supply chain insight on certain feed products. Customs data signal 3 consignments that give rise to questions. Insight was gained on the technical possibilities of the system. An importer was found, unknown to the NVWA despite the obligation to register. Attuned inspections (telephone call) sufficed to establish compliance, saving supervisory capacity and preventing a burden to trade. Risk would not have been seen without the Customs data.
34	Verify a signal on fraud, starting with identifying the consignment before entry, and verify compliance. Customs data enables signalling the shipment, subsequently enabling signalling the shipment in NVWA data. Attuned supervisory action could be planned upon arrival in the port of Rotterdam, the intervention prepared. Fraud was detected, gaming confirmed, the consignment stopped. Knowledge on a company, product and risk were the additional gains. The timely response prevented problem solving afterwards.

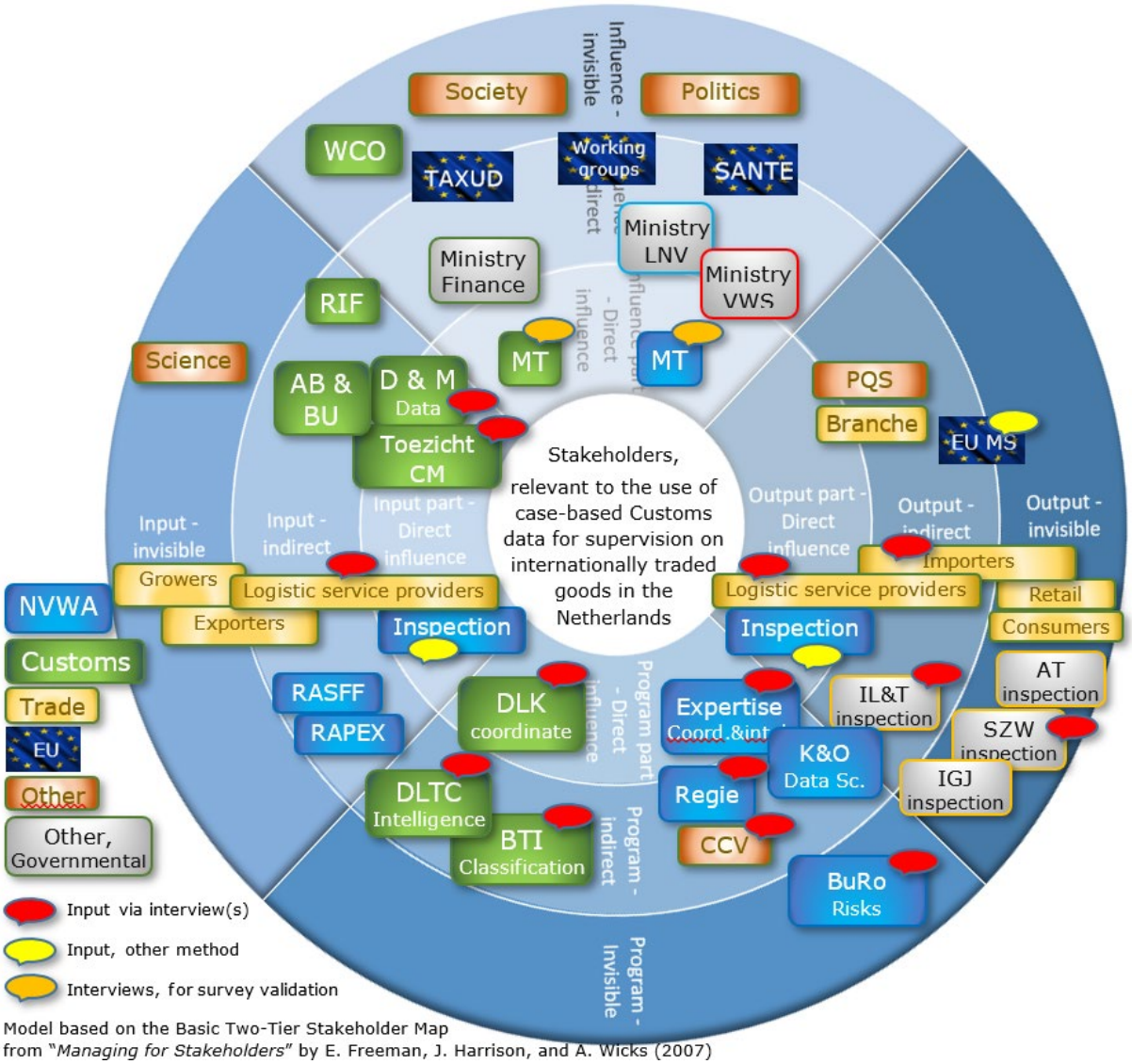
Stakeholder interviews

The stakeholder selection for interviews follows from stakeholder mapping, based on the Basic Two-Tier Stakeholder Map (Freeman, Harrison, & Wicks, 2007). The map is built from the middle; the main research question is the starting point.

Of the four quarters, left and right represent the input (left) side and output (right) side of the process. At the top are the stakeholders with influence, such as management. At the bottom are stakeholders that program the process. The process it selves shows, via yellow elements, from left to right, horizontally in the middle.
Stakeholders are positioned according to their contribution to - and influence on the process: direct influencers in the inner ring, stakeholders with less influence in the subsequent rings towards the outside. Stakeholders with more than one role, are positioned at their most influential position. For instance science has influence on more than one aspect of this research. The logistic service providers may appear an exception. But in practice with internationally traded goods, the one from the input – and output side may differ. Inspectorates other than the NVWA are depicted, on the right side, below the middle. The contributions differ in visibility to the research question, based on the relationship: the NVWA already cooperates with IL&T for risk-based import controls on tactical and operational level. While the relationship with the other inspectorates is less far developed. Due to COVID-19 crisis, not all scheduled interviews were held as planned, five were held by telephone instead (Respondents N, P, S, T, U).
The group-wise input from the NVWA inspectors during a team meeting could not take place due to the COVID-19 crisis. Instead, the researcher placed posters in the inspectors' office in Zwijndrecht. The introduction to the research and the questions raised, were emailed. The content was unchanged.

FIGURE 8

Stakeholder Mapping as a basis for interviewee Selection



Model based on the Basic Two-Tier Stakeholder Map from "*Managing for Stakeholders*" by E. Freeman, J. Harrison, and A. Wicks (2007)

TABLE 7

Overview of the Stakeholder Interviews on the Process

Interviewee	Substantiation	Supervision	Data use	Cooperation	Classificatio	Monitoring	Effect of supervision	SCFs	
Respondents A	Customs experts from BTI – Binding Tariff Information about Classification (I)				X				
Respondent B	Importer of feed additives, with knowledge on the supply chain and experience on being supervised (I)						X		
Respondent C	Customs expert on processing data requests, and 'dossierhouder' on food and feed safety (I)								
Respondent D	Data scientist of the Openbaar Ministerie (OM) with expertise in joint data use and supervision (I)	X	X	X					
Respondent E	Customs expert on processing data requests (I)	X	X	X	X	X			
Respondent F	Customs expert on covering food- and feed risks (I)	X	X	X	X	X			
Respondent G	NVWA expert in NCP controls on tactical level (I)	X	X	X	X	X	X		
Respondent H	Expert in supervision from the CCV, Centrum voor Criminaliteitspreventie en Veiligheid – familiar with the NVWA and Customs (I)	X					X		
Respondent I	Customs manager at an International Logistic Service Provider, professionally involved in monitoring (I)	X				X	X		
Respondent J	NVWA Expert on optimal supervision (I)	X					X		
Respondents K	Customs Experts, familiar with monitoring (I)	X	X	X			X		
Respondents L	NVWA experts; the head of the unit risk assessment and the officer from the unit Knowledge and research, involved in monitoring (I)	X					X	X	
Respondent M	IT expert, familiar with Customs data use (I)							X	
Respondents N	NVWA experts in monitoring, as officer on a tactical level and team leader of the inspectors (I)	X				X	X		
Respondents O	Inspectors that perform monitoring (G)	X		X		X		X	
Respondent P	Customs Management, responsible for IT and data use. Validation of Survey findings (I)			X					
Respondent Q	Project leader import controls of the inspectorate for the ministry of social affairs and employment. To validate and support generalization of findings (I)	X		X			X	X	
Respondent R	NVWA Coordinating Specialist on feed safety (I)	X					X		
Respondent S	NVWA Management involved in data use and IT infrastructure. Validation of Survey findings (I)			X					
Respondent T	IL&T Expert in the export of waste & environmental issues. To validate and support generalization (I)	X		X			X	X	
Respondent U	IL&T Expert in import and transport of dangerous goods and organisms. To validate and support generalization (I)	X		X			X	X	
Respondent V	Operational Specialist at the Police, thesis supervisor on data exchange between the Police and Customs. For the purpose of generalization (I)							X	

The survey on factors

Due to COVID-19 crisis, the planned introduction to the survey during a Network meeting could not take place, and was presented by email instead. The survey remained the same. From the 21 network members, ten responded on the survey, as requested, both descriptive and by scaling the categories.

The case study

To investigate effects from non-aligned EU law, the aspect of goods identification was investigated. The EU register with all authorised feed additives on a given date, edition 8/2019 (274) of 5-9-2019, was converted into CN codes based on the goods description. The purposive sampling of the most relevant feed additives, for the check on the conversion by Customs experts, resulted in a selection of 34 records of feed additives that contain copper or zinc, vitamin B12, some botanicals, and some flavourings. Given the calculated minimum sample size of 33, all 34 records were included in the sample. The BTI experts, Respondents A, reported a correct conversion into CN codes by email.

3.4 Validity and reliability of this research

Construct validity
Construct validity is the quality of the relationship between the theoretical and empirical parts of a study. Multiple tactics were used to ensure construct validity. This research was initiated by a research proposal that included preliminary research questions, the scope of the study, delineation, and the research framework (Hevner, March, & Park, 2004). Any alterations to the research proposal are presented in this report (see § 3.3).
To ensure contributions from all relevant perspectives and stakeholders, the stakeholders from the research framework (see Annex 1), were fleshed out and mapped. The mapping was reviewed and validated via stakeholder interviews. To create a chain of evidence (Frohlich, Tsikriktsis, & Voss, 2002), all collected data were stored; notes, interview protocols, recordings, all versions of interview transcripts, historical data from data requests, etc. Only validated input served as input for this research. The green light version of the report was reviewed by two peer academics, both Customs officers (Respondent W, X), whom were not involved in this research (Gibbert, Ruigrok, & Wicki, 2008).

Internal validation
Internal validation is the extent to which the evidence supports the claim of cause and effect: findings from the research should contribute to the research question. Therefore, all research material was collected and stored, with all relevant data presented in this report.
Both supporting- and counter evidence were sought (Gibbert, Ruigrok, & Wicki, 2008). Triangulation was applied, to be complete and unbiased. Findings were reflected upon in interviews, with the experts on different topics.
For the semi-structured interviews, predetermined interview protocols were sent to the interviewees beforehand. Every protocol included an introduction to the research and instructions for the beginning and the end of the interview to avoid forgetting any aspect (Furgerson & Jacob, 2012). During interviews, notes were taken, some interviews were recorded. Only validated transcripts served as input. The researcher selected interviewees who would represent multiple viewpoints in the research. To be complete, all stakeholders were mapped based on their relevance to the research question. The mapping was verified and validated during stakeholder interviews.
Historical data requests were inventoried and investigated based on case-specific data and overarching interviews. The transcript of the investigation was also verified for correctness and completeness.
To limit possible bias, being an attached insider as the researcher, research methods that limit bias were selected, if possible. In case of interviews, the predetermined protocol prevented interviewer bias, the transcript validation served to address response- and reporting bias. Multiple data sources were sought, historical data used. Peer review will be applied, via peer academics not involved in the research or the supervision. The single case study requires conversion, that conversion will be checked by Customs experts, using a purposive sample of a pre-calculated size.

External validation
The findings of this research were analysed to determine their generalisability. To check if the domain of subject is not an outlier that cannot be generalised, the researcher studied its development, to determine if it aligns with the development of other domains. Findings were validated via interviews, both for triangulation and to limit research bias. To support generalisation, the researcher selected all historic data requests and used a cross-case analysis to detect similarities so that the findings do not rely on a single request. Moreover, the researcher archived all process steps for transparency and replicability of the research. Data are annexed in the report and available from the researcher upon request (Frohlich, Tsikriktsis, & Voss, 2002), (Ebneyamini & Moghadam, 2018).

Reliability
For research to be reliable, a replication of the research should generate similar findings. Therefore, all steps of the process, planned and executed, are documented, and described in this report. All data were recorded and stored (Frohlich, Tsikriktsis, & Voss, 2002), including raw data from email messages and files. Some data are not presented in this report for confidentiality, but all data are available at the researcher. Data not subject to confidentiality will be presented upon request.

Summary of Chapter 3

This research used exploratory and qualitative research, to gain knowledge and understanding by creating a theory in the field of interest not extensively studied in previous research. The collected historical data in this research required a cross-case analysis. Thus, two types of interviews were conducted: expert interviews about data requests, and stakeholder interviews about the process. A survey identified factors that determine success via a single case study to investigate the consequences of on non-aligned EU regulations. The COVID-19 crisis caused some adjustments in the data collection.

From the conceptual model, the part is operationalised that is directly influenced by the data use; Customs data are input for the process. These phases are compliance prediction (phase 2), preparation of supervision (phase 3), and compliance detection (phase 4).

To ensure a valid and reliable research, multiple tactics apply, including efforts to limit bias.

4. Results, Discussion

This chapter describes the findings based on the data collection, per supervisory phase. To establish if practical data can confirm the theory the conceptual model presents. Following the findings, there is a discussion on a number of aspects that deserve consideration.

4.1 The prediction of compliance

The NVWA is obliged to perform monitoring on internationally traded goods but lacks information to supervise efficient and effectively. From Customs, case-based information is obtained to predict compliance (see Annex 5). For example, a mycotoxin expert knows that peanuts originating from a particular non-EU country pose a risk. Customs data on the supply chain can serve to find if that compliance risk applies to the Netherlands, if monitoring should be executed.
From the finalised data requests, ten intended to predict compliance (purpose code 1.2), these will be analysed in this section. In all these cases, missing information was obtained (code 5.1), using one to five risk indicators (code 2.10-2.14). When one indicator applied, it concerned details on a company (code 2.10). In nine out of ten cases, import data were requested (code 2.1), the other request targeted export and exit data (code 2.2, 2.4).

Better data; availability and accessibility
Customs data are available on demand to the NVWA, based on an annex to a covenant on ministerial level, that allows data exchange for the purpose of supervision, by officers whom need the data to perform their tasks. Eight out of the ten requests on compliance prediction, had problems with the availability of data (code 3.3, 8 cases), but all were executable though (code 3.2). Other problems (code 3) do not relate to reliability but for instance to capacity.

From interviews, the availability appears to be problematic from time to time; it appeared that, on one occasion when the availability was limited, the cause was a blockage, needed to secure the accessibility of data within the Customs Administration (Respondent F). Respondent C explained the Customs tool to send data in a secure way, is not always available. On other occasions of limited availability, causes were unknown, according to Respondent C and E.

With every data request, the NVWA had to solve issues (annex 6) before data could be requested. Issues vary, from data quality, to consequences of non-aligned EU regulations, and from other causes. Regardless the occurrence of issues, data requests were accepted in all cases.

During stakeholder interviews, the occurrence of issues is recognised by experts from the NVWA, Customs and IL&T. It was stated that knowledge and experience on Customs processes, -law, and -data is required to address the issues. NVWA; Respondents G, N. Customs; Respondent C, E, F. ILT; Respondent T, U.

The issue of non-aligned EU regulations shows, for example via goods identification. At import, Customs applies classification, using the Harmonised System. At entry, a description must identify goods. Both systems do not necessarily align with the identification in other regulations.
From the case study, the investigated version of the feed additive catalogue presents 1.557 entries, that vary from general (i.e. "*Ferric oxide*") to very specific combinations. (i.e. "*Preparation 6-phytase produced by Komagataella pastoris (DSM 23036)*"). Approximately half of the entries can be translated into a CN code on a one-to-one basis (48%). Other entries require 2 or 3 CN codes each, such as a single entry that represents an oil, essence and extract of a product. Moreover, there is overlap with 214 entries. For instance there is an entry converted into the code 3301, another entry is part of that via code 3301 1190. From the reverse viewpoint, from CN code to entry, an extreme appears: one single code (2102 1090 10) represents 122 feed additive entries (enzymes, all different).
In practice, as a consequence of this non-alignment, room for divergent interpretation exists, hence for discussion in the supervisory practice. Consider goods subject to official controls, but these are circumvented, based on the interpretation of the goods identification. Thus, the goods identification

limits the availability and usefulness of Customs data, for the supervision. A data request (case 31) confirms this occurs in practice.

During an interview Respondent F poses, Customs data security proved to be so rigorous that it is at the expense of availability and efficiency. The NVWA officers, as interview with Respondent G learned, store and use Customs data in a secured location, the access rights are limited to officers involved in the monitoring of internationally traded goods. Officers are deprived of access rights when they change position.

Better data; improved data quality
Based on external data use, in one case (nr. 23, see Annex 5, second part), missing data was imputed. Customs had offered cropped data in response to the request, as usual. After combining the NVWA and Customs data, the combination of multiple data elements (i.e. MRN number, date, company details) made it possible to complete an essential missing data element, namely the container number. There is no alternative to complete the data, because the only option is performing an inspection, which is impossible since the goods were already exported at the moment the lacking data element was detected.
Detection of formerly unknonw subjects occurred (code 7.11), but not with requests that aimed to predict compliance. However, companies were found to be importers, formerly unknown for their imports (i.e. case nr. 4).

Concluding that the data quality improves and results in better data, based on the accessibility of data (1), the occurrence of imputation (2), and the detection of formerly unknown subjects (3) can be confirmed. The availability of data (1) does improve using external data, but disruptions occur.

Better identified subjects
The NVWA lacks data on incoming or exiting consignments. Without identification of subjects, supervision on internationally traded goods is destined to search for a needle in a haystack.

Unnecessary inspections were prevented (4) by establishing compliance based on Customs data in four cases (code 6.1, four cases), making an inspection redundant. Supervision became possible due to Customs data, in one case (code 6.3; one case), attuned supervision in four cases (code 6.2), and a replaced inspection in one case (code 6.4). The effect of enabled actions can be considered by having to inspect over 100 companies to establish if a certain product with a high risk is imported: it is very likely that there is not enough capacity to cover an immediate risk on short notice. Depending on the purpose of the historic data requests, subjects as companies or products were identified. In 16 cases towards companies as a subject (code 7.1), in ten cases, towards products as a subject (code 7.2). Timely detected non-compliances, only seen because external data were used (6) occurred with one data request (nr. 31): inconsistencies were detected that indicated fraud, that could not have been signalled in any other way.

Stakeholder interviews (Respondents G, R) confirm that the use of Customs data can help to identify subjects that require supervision, more sharply. The identification facilitates supervision (Respondents G, N) that is otherwise impossible.

Concluding that the subject identification benefits from the use of external data.

Supervisory response on signals and trends
Signals that were not missed out, or timely responded to (7) appear from one case (code 6.3, two cases). The use of Customs data enabled the NVWA to timely see what was going on with a consignment, posing a risk. Customs data revealed details, that enabled supervision and intervention. The other request served to verify a tip. While goods were on their way to the Netherlands, the use of Customs data enabled an inspection and intervention, at the moment of arrival, at the right place. In both cases, without the Customs data, the NVWA would have missed out in the opportunity to inspect, hence on the opportunity to check compliance, because the consignments could not have been inspected afterwards; goods moved elsewhere and are used or consumed.

Stakeholder interviews (Respondents N, T, U) confirmed the detection of some subjects would have remained unnoticed without Customs data.
Moreover, data were not analyzed, supported by technology (code 4.2, all cases) which Respondents N confirmed in their interview. Handcraft is considered a waste of effort because it is too burdensome, stated de Respondents K in their interview, and technology supports better analysis. Moreover, from the interview with Respondent S, it shows that the support of technology suits the NVWAs ambition on data use. Thus, there is room and ambition for improvement on the data analysis part of the process.

Subjects to supervise upon, unknown without the use of external data (3) is elaborated upon, in a previous section, on data quality.

Concluding that the response to signals and trends benefits from the use of external data.

4.2 The preparation of the supervision

When preparing supervision, using external data can make a difference. For example when data analysis can signal leads, the inspection can be attuned towards collecting more information on that lead, rather than reviewing a companies' procedures and systems to obtain the same knowledge.
From the finalised data requests, nine intended to prepare supervision (purpose code 1.3), these will be analysed in this section. In all these cases except one (nr. 21), missing information was obtained (code 5.1), using a single risk indicator in six cases, two or four indicators in the other cases (code 2.10-2.14). When one indicator applied, it concerned details on a company or a product (code 2.10, 2.11). In six out of nine cases, import data were requested (code 2.1), entry data in three cases (code 2.3). With two other request, leads were sought on a specific consignment (nr. 10 ,11).

Attuned supervision
Variation in actions (1) shows from the data requests, within a certain range (code 6.2). From the common inspection visit, to an inspection visit tailored to the risk sought (i.e. nr. 10), to a telephone call (i.e. nr. 31). Without Customs data, more burdensome inspections would be needed to establish the same knowledge on the risk.

Towards leaving room for autonomy: from the data requests it shows that the NVWA has used Customs data for internal purposes; for instance to predict compliance of a subject. The covenant that allows data use, focusses on the use by the NVWA only, for the purpose of supervision (Belastingdienst f, 2020). Interviews (Respondents G, N) confirmed that no data or findings were shared.

The NVWA procedures on inspection processes do not take attuning into account. The data requests (code 6.2) and an interview (Respondents N) confirm the occurrence of attuned supervision though.

The five strategic goals of the NVWA all aim to stimulate compliance by providing information (NVWA b, 2020), but none relates to sharing the outcome of a compliance prediction. Sharing of information is called essential during an NVWA interview (Respondents L): the use of a feedback loop to share compliance predictions with companies, rather than automatically responding to risks by performing inspections, is considered a step forward. Moreover, Respondent H, an expert on supervision, stated that sharing compliance predictions with companies is considered to enhance a better distribution of accountability and liability. Consequently the supervisor can better adhere to his role, and cannot become the problem owner of non-compliance. Respondent H and I pose that companies welcome risk information, as input for risk management, being the one responsible for solving non-compliance. This is preferred over awaiting an inspection visit. Respondents K pose that upon informing a company about supervisory findings, announcing when the next inspection will take place, can incentivize compliance. By a longer period until the next inspection in case of compliance, or a shorter period detected with non-compliance.

The effect of tailored actions (2) (code 6.2) appear from the data requests; it shows that using external data can clarify issues, having the NVWA decide not to execute the common supervisory

action of an inspection. But facilitate efforts that are less intense and less intrusive, that cost less capacity, while sorting the same effect. An example is when based on data, instead of an inspection visit, a phone call sufficed to verify compliance (i.e. nr. 31).
Respondents N confirm, when interviewed, the prevention of unnecessary actions, using Customs data.

Concluding that the supervision benefits from the use of external data, via attuned actions.

Gaming, overlap and underlap;
Gaming (6), when preparing supervision, is presented by companies that circumvent obligatory controls. Circumvention saves a company the costs and delay of an official control. Such behaviour must be addressed by the NVWA via monitoring. With thirteen data requests, this circumvention was checked; Customs data provide insight on whether official controls were respected (code 7.21). In one case (nr. 34), gaming could be confirmed, but this did not concern the preparation of supervision.

Overlap (7) when viewed from data requests, might occur when in one case the subject is a company, and in another case, a product or risk. However, not every signal induces an inspection, in practice overlapping efforts do not necessarily result in overlapping inspections. From data requests it shows that the action of analysing data, targeting a company to discover if official controls are being respected, replaces an inspection visit and thus prevents overlap. The chance on overlap of a Customs and NVWA inspection is confirmed by interview (Respondents K). Overlap on a larger scale, when multiple supervisors target the same subject for different risks, was the purpose of one not yet finalised request, that was left out of scope given that status.
Underlap (7) may occur if importers are unknown to the NVWA. The register of known companies serves as the source to select subjects for supervision. The importance of a complete register of importers is acknowledged during a stakeholder interview (Respondent R); to prevent unregistered companies to remain 'unseen' by the NVWA. Formerly unknown subjects occurred (5) with three requests. Importers unknown to the NVWA (code 7.11), that should have registered themselves, were identified (i.e. nr. 20).

Efforts that do not contribute to risk reduction (7) and inspection frequencies (8) were not measured, it is questionable if this is even possible in practice, given the difficulties to establish causality.

Interviews showed that the selection of subjects was not a joint effort (Respondents C, E, F, G, N). It is recommended though, for the ability to prevent (Respondents K).

Concluding that gaming (6) is detected and overlap and underlap are limited (7) using external data, with room for improvement towards the prevention overlap.

Deployed capacity
Previously in this section, based on data requests, it showed that the capacity used to address a risk, is less when external data support the preparation of supervision. The subjects are better-identified, based on better data, actions are attuned to the risk sought. Consider a visit to a sharply identified company for a specific risk, compared to a random inspection with a general list of items to assess. With the Customs data, a timely response prevented problem solving afterwards (code 7.31).

The efficiency from timely responding, before internationally traded goods are distributed into smaller quantities, was confirmed by Respondents G and J, during interviews.

Towards the available capacity, the commanding ministry annually decides on the NVWAs tasks and resources, and as a consequence, on the capacity (NVWA d, 2020). Based on data requests, better planning was possible with five requests (code 7.41). Without the data from Customs, the response from the NVWA would have been impossible (code 6.3; one case). One data request (nr. 2) facilitated the planning of inspectors for the next half year, and the associated laboratory capacity.
One exceptional data request (nr. 23) aimed to replace simple physical inspections on terminals in the port of Rotterdam upon the exit of goods, on 8,153 containers annually. Data use in this request replaces the work of an estimated two full-time inspectors, by spending approximately one week on

data analysis. More common is a less extreme gain; consider an analysis on a dataset that provides insight on the consignments of many companies costing an officer half a day's work, as opposed to half a day for visiting and inspecting every single company.

The interviews with Respondents K confirms that the use of Customs data support better prediction and preparation: actions can be attuned to the risk targeted. As a consequence, facilitating a better planning of capacity and, if needed, prioritising.

Concluding that the capacity used to address a risk (10), and the planning of capacity (11), benefit from the use of external data.

4.3 Supervise to check compliance

In compliance monitoring, the use of external data can make a difference. For example, an inspection may focus on the risk sought, facilitated by external data, and thus be confined. An efficient inspection is less intrusive for the company visited. In fact, when data analysis sufficives to verify compliance, an inspection becomes obsolete.
From the finalised data requests, three intended to check compliance when supervising (purpose code 1.4), these will be analysed in this section. In all these cases, missing information was obtained (code 5.1), using one or five risk indicators (code 2.10-2.14). When one indicator applied (nr. 18), it concerned a product (code 2.11). In one cases, import data were requested (code 2.1), the other two request targeted export and exit data (code 2.2, 2.4).

Monitor compliance
One data request shows that for monitoring compliance, external data use partly replaced (1) the commonly performed inspection visit; attuned action served to establish compliance in a more efficient, and less intrusive manner (code 6.2). One succeeded data request, intended to replace physical inspections, by data analysis (nr. 24).

It is confirmed in an interview by Respondent C, that data can (partly) replace monitoring.

Concluding that external data can replace monitoring, to check compliance (1), partly or complete.

Focus during inspections
The NVWA inspects risk-based and data-driven (Ministeries van VWS en EZ, 2015). External data can help having an inspector find the risk sought when supervising to check compliance. Data requests show, that attuned supervision applies to one case (code 6.2). Case nr. 18 with a product-related risk requested Customs data on the product. The data presented the relevant consignments of a number of companies. Inspectors could confine their actions towards the specific consignments, at the identified companies.

Respondent C and G pose, when interviewed, that the Customs data use facilitates efficient actions. Especially when data leads to a specific consignment or documents. It is estimated that the time saved by shorter inspection due to more focused effort is exceeding the time that data analysis entails.

Concluding that focus during inspections can enhance the monitoring, to check compliance (2).

Better informed inspections
The use of Customs data, can better inform an inspector prior to his actions. More information is available (3) on the subject, being a company, product or risk, to supports the inspector in checking the compliance.
Data requests show that with one request, the inspector was better-informed, enabling attuned supervision (code 6.2). The inspector knew at what product and consignment to look per company.

During interviews with Respondent C and G, it is confirmed that Customs data can help to inspect, being better-informed. The chance to find what is sought, is considered to be bigger. This is not substantiated with an example or with an estimation on the difference it makes.

Concluding that better-informed inspections can enhance the monitoring, to check compliance (2).

The prevention of inconsistencies
When using external data to perform supervision, this can help to act more consistent, more uniform. From the NVWA website it shows that procedures and policies apply within the NVWA, also to inspections, not on the use of Customs data.

When consistency is considered determining if obligatory official controls were obeyed, since all companies should do so, than all three requests show that Customs data enhance consistency (code 7.21).

The use of Customs data is assumed to promote variation, by tailoring efforts to the risk sought and thus have inspectors act more efficient and less intrusive. The opposite of consistency appears to occur, based on an interview with Respondents N.

Concluding that external data can promote consistency in subject selection, inspections when tailored, are less consistent but more efficient and effective.

4.4 The evaluation of supervision

An evaluation to measure the coverage of all risks that the monitoring targets, is not available on the period of research.
The NVWA does however, measure on a more general level, this is communicated in divergent forms (NVWA c, 2020), (NVWA a, 2018), (Boerderij, 2020), (Voedingscentrum, 2020). Moreover, risks and consumer trust are monitored (Oirschot, Temminghoff, & van der Velden, 2018).
Currently, tools to provide information, such as on the compliance levels, called "de naleefmonitor" and to inform consumers on findings, called "openbaarmaking", are developed (NVWA e, 2020).

4.5 Factors that determine success (CSFs)

From a tactical level, the survey response on the factors that determine success, when using Customs data, were almost all valued as equally important, except for the external factors, that were valued less important. From the management interviews that served to validate the findings, trust was valued as the most important factor, above all. At the level of factors, stakeholder interviews provided a large variety of factors, with trust as the overriding factor, and commitment.
All respondents, as a precondition, stated the data use must fit within the legal frameworks.

Data are a precondition for better supervision. There is a shared concern on data quality from all respondents: insufficient quality may hinder the reliability of conclusions drawn. This is stated in interviews with Respondent B interviewee, Respondent C, F, P, and Q, and in the survey response of the NVWA Douane Netwerk. In addition, usability and purpose limitation are to be established, pose Respondent B, C, E, P and S.

The survey response states that the NVWA should, proactively establish what data is needed, rather than passively learning about the possibilities the current Customs data offer. The interview with Groothuis learns that IL&T currently explores the possibilities of Customs data, in relation to their supervisory needs. The survey response on the NVWA's current data collection, domain-wise, could benefit from a centralised approach, to increase the efficiency and usability of Customs data.

A shared data use is welcomed by all survey respondents. The management interviews with Respondent P and S reveal that shared data use meets the management ambition on both data use

and the prevention of duplicated efforts. Management welcomes a shared data foundation, and the possibility to adjust the supervision's intensity, aligned with the trust in compliant companies.
In another interview with Respondents L, the application of a feedback loop with trusted companies, to share outcomes of risk analyses, is posed to further promote compliance, which Respondent H poses, would result in better-distributed roles, responsibilities and liability. The NVWA's Douane Netwerk in their survey response, questions if shared data use is feasible; commanding ministries may set other priorities.
Moreover, when using Customs data, comprehension on what the data mean, is indispensable. As interviewee Respondent C stated: "*Exchanging data is good, but we speak a different language. It can be difficult to create a common language*". We implies Customs and the NVWA.

In addition to data, a proper functioning **IT system** is considered a precondition for any supervisory action, poses Respondent J in an interview. While the NVWA's IT systems are currently under reconsideration (NVWA f, 2020). Nevertheless, while working on a better system, there are other possibilities to improve the information position, shown from divergent initiatives and examples that do not require an ambitious approach, state multiple interviewees: Respondent B, J and N. The input from the inspectors performing monitoring, confirms that small scale improvements are possible.

A network is considered indispensable to constructively cooperate with Customs, by interviewees (Respondent R, T) and the inspectors that perform monitoring.
This is confirmed by other recent research, poses Respondent V when interviewed, on behalf of a supervisor that does not focus on internationally traded goods by nature.
The survey response of the NVWA Douane Network poses that a system, to well-function, depends on the people whom are part of it, and their facilitation, by ICT and data. It is questioned whether the relatively aged working force can promote increased data use.

Strikingly is the importance of applying societal information for supervision, since companies are believed to respond differently to consumers than to the supervisor, according to survey response of the NVWA Douane Network. This indirectly advocates tripartism. Respondent H confirms this when being interviewed on supervision.
The NVWA Douane Network believes that society accepts external data use for supervision, since the data use can help to meet the societal expectations.

Management emphasises in an interview (Respondent P) that the moral appropriateness and effectiveness of data use is of concern. The importance and proportionality of supervision is a decision, to be made by political decision-makers; for example by weighing an individual's privacy's importance against the public values of supervision. Furthermore, from the management perspective, both Respondent P and S, prefer to develop towards enhanced data use, by seeking possibilities rather than impossibilities, by establishing and demonstrating added values, that should be based on mutual trust and commitment from the cooperating supervisors.

4.6 Discussion

A condition for supervision; a continuous process
To establish food and feed safety, supervision is indispensable (Beck, 1992). Supervision should be continuous to be effective (Mertens a, 2011), hence a cyclic process. Since solely perceiving supervision already affects the compliance (Foucault, 1975): the elasticity of the concept of continuous can be discussed: what its range is, what already is perceived as supervision.

Unnecessary inspections
The operationalisation of the conceptual model introduces the concept of unnecessary inspections; to indicate an avoidable burden on companies, from the viewpoint of controlling a risk. It can be discussed if a concept as an unnecessary inspection can exist, viewed from the theory of Foucault (1975), that when supervision is perceived present, it already influences compliance.

Evaluation of supervision

No capacity will suffice to cover all safety risks: not all risks are known and measurable. In practice, there are blind spots and bias (Bach & Wegrich, 2018), (Honingh & de Wolf, 2014). Thus, some risks worth addressing, are out of scope (Power, 2004), (Sparrow, 2000). Regardless the capacity, supervision can never safeguard against every risk. The risk-based approach aims to cover the most significant risks. It can be discussed what the most significant risks are, given the blind spots, and when these are sufficiently addressed. Whether there is a minimum on supervision, without compromising safety.

Tripartism, a condition for supervision

When reviewing the GFL on tripartism; roles are assigned to all three parties. The designated authorities are obliged to supervise, and intervene if needed. The companies' role mainly constitutes of the precautionary principle (article 7), obliging companies to take (preventive) action to ensure consumer protection, and from the facilitation of self-regulation (article 17).
In contrast, consumers have a limited, and passive role: the GFL aims to enable them in making their own, well informed choices. Facilitated by mandatory product information that must be correct (article 4 and 8), and communication about detected risks.
It can be discussed whether this role distribution facilitates the tripartism, the literature of Ayres & Braithwaite (1992) describes, to prevent games between supervisors and the ones supervised.

Future risk-based supervision versus inherited bias

The GFL supports risk-based supervision (EU d, 2018). Risk-based supervision that is based on expert-based supervision, inevitably inherited the blind spots and inspectors bias'. This may influence risk-based supervision, and all subsequent types of supervision, based on it.
Literature states that data will change the way decisions are made, and its outcomes (Ayres a, 2007). Data would complete the current supervision. I question whether the use of external data, can compensate for the bias inherited from previous supervision, to improve future supervision. Especially when external data originate from other supervision, that is selective by nature.

Responsiveness, a conditions for supervision, including interventions

Responsiveness, for instance by being flexible, is an important condition for supervision (Ayres b & Braithwaite, 1992). The NVWA's intervention policies have recently been updated and made more uniform; have companies know what they can expect if non-compliance is detected.
The uniformed interventions are not flexible by nature, in contrast to the flexibility that Responsive Regulation foresees. On the other hand, practice might benefit from uniformity in the supervisory practice; applying responsiveness has proven to be difficult to achieve (Mascini & van Wijk, 2008). It can be discussed what flexibility would be appropriate and workable, when intervening.
Moreover, the intervention policies are publicly published, amongst others to be transparent. However, the question of whether publishing documents can be considered transparent can be discussed, when the content is difficult to understand.

Summary of Chapter 4

All supervisory phases, demonstrably benefit from external data use, after issues are addressed, when data are available and the access secured. The external data use improved data quality, formerly unknown subjects were detected, other subjects were identified more accurately and timely, and signals and trends were responded to in a more timely manner. In one instance, even fraud was detected. External data use allows for attunement of actions to the determined risks, reducing gaming, overlap, and underlap, which requires less capacity. In this way, available capacity can be planned more effectively and efficiently.
Data on evaluations were not useful to this research. The factors that determine success are manifold, trust overrides all. Other factors include the data, the technology to use them, the people in the system, the network, and the importance of applying societal information to supervision. The discussion focusses on the continuity, responsiveness and evaluation of supervision, the concept of unnecessary inspections, tripartism in the GFL, and the bias in selective supervision.

5 Conclusion, Limitations, Contributions and Recommendations

This chapter presents the conclusions from this research as well as limitations, contributions, and recommendations for further research.

5.1 Conclusion of the research and sub-research questions

This research was to explore the use of Customs data for the supervision of internationally traded goods for food and feed safety. By adding knowledge about the use of external data for supervision. Therefore, this section answers the research and sub-research questions.

Q1. How has the use of external data changed the supervision and why?
Supervision has evolved, from expert-based to risk-based, to data-driven supervision. Expert-based supervision enables experts in the field, inspectors, to determine compliance. However, inspectors are not omnipresent and omniscient. Risk-based supervision help to prioritise the most significant risks. Data-driven supervision builds on risk-based supervision by adding data on subjects (a company, product or risk). Adding external data supports all supervisory phases, making it a continuous, effective process based on better data. However, solely adding data does not suffice; knowledge of the data is required to determine the meaning.

The effects differ per phase, where the data serve as direct input. When data for supervision are completed and become more accurate, compliance can be predicted and established more sharply and timely, which can prevent missing out on subjects or opportunities to supervise, or not detecting non-compliance. The supervision can be better-planned and resources can be better-deployed. Supervisory efforts are more informed and more targeted, tailored to the risk sought, and less susceptible for gaming, overlap and underlap.

The researched use of data, is not supported by the use of technology to enhance its effects. Neither was the data shared, nor used as a continuous process, and data availability was not secured. However, effects were established. Hence, the elimination of duplicate efforts, such as data analysis, can increase mutual benefits, by decreasing overlap, underlap and gaming.

Q2. How can supervisory effects be evaluated?
Supervision can affect different levels: the micro level, with the compliance of an inspected company or product, at the macro level, with a group of companies or a domain, and the meso level, with systems, including a public health system, and trust in food and feed safety.
Measuring effect is increasingly difficult, depending on the complexity of the context. Moreover, it is difficult to substantiate causality in supervision, to determine the extent to which an effect results from supervision. Because risk-based supervision is selective, and the measuring of effect implies that all risks are known and can be measured, which is unrealistic in practice.

Although compliance is the responsibility of a company, the current micro-level evaluation emphasises the assessment of compliance, rather than the assessment of a company's compliance evaluation.

Q3. Which factors determine the occurrence of the effects?
The use of external data not solely depend on the context, since factors that determine success are manifold. Based on the literature, categories and subsequent factors cannot be differentiated on importance or feasibility in the use of external data for supervision. Therefore, the categories of collected factors in sections of the research question are, in random order, human performance, strategic, organisational, operational, IT, data, finance, legal, and external.
Factors can determine but cannot guarantee success; conditions, including legislation, may prevent the occurrence of success.

Q4. What restrictions and problems have the NVWA experienced in the retrieving and analysing of Customs data , and what has been the impact on the effects?
In order to compile a data request, problems must be overcome that emanate, for example, from non-aligned EU regulations, for example the different identification of goods. Customs applies classification via the HS at import and a description at entry, other regulations do not necessarily apply the same identification method. As a consequence of non-aligned goods identification, data may not be specific or complete enough to meet the purpose of the intended data use.

Other issues concern the quality and usefulness of data: questioning if data are actual, complete, correct, sufficiently detailed and available. Regardless the issues, data are obtained in practice, adhering to the legislation on the use of external data. To analyse retrieved data, the NVWAs data processing capacity, unsupported by technology, could hinder a timely analysis. Moreover, technology may generate signals that remain otherwise unseen.

To enhance the use of external data, possibly towards a shared data foundation, first, supervisors must establish mutual trust between one another. Therefore, regulations on data use must be respected. Aspects that concern Human Resources, IT systems and technology must support the data use. Additionally, data quality, usability and purpose limitation are necessary operational prerequisites for data use.

Q5. What is the effect of the data use, in terms of benefits to regulatory effectiveness and efficiency, intrusiveness and public values?
Effectiveness viewed from responsiveness, should leave room for autonomy to the one supervised; the supervision commonly responded to signals by an inspection, rather than sharing that information with a company. Sharing signals, however, can enhance compliance due to the better distribution of roles, accountability, and liability. Effective supervision applies a positive strategy; however, the intervention policy only facilitates interventions in response to non-compliance. Moreover, efficient supervision spends its capacity, proportionate to the targeted risks, prioritising the most significant risks. The supervision that was researched meets these criteria but could not be substantiated by data other than interviews.

The intrusiveness of supervision should be limited by preventing the unnecessary hinderance of legitimate actions, as far as this does not compromise the regulatory aim. This limitations contributes to the trade facilitation that both the GFL and UCC demand, and is achieved via the replacement of physical inspections by data analysis, the completion of a company register for selecting subjects, and fewer inspections needed to address risks, because of better-attuned supervisory actions. Moreover, public values should consist of transparency, public accountability and sufficient capacity, to legitimise actions taken.

The organisational benefits, mainly efficiency and effectiveness, are due to trust-based cooperation with Customs. This cooperation can be improved trough the development of a balanced relationship, that results in increased mutual benefits. However, such cooperation requires continual investment in trust, technology and capacity.

The main research question of this research is

How are case-based Customs data used for food and feed safety supervision in the Netherlands of internationally traded goods, and to what effect?

Based on the conceptual model, the use of external data can enhance supervision in multiple ways. The use of case-based Customs data positively influences effectiveness and efficiency, decreases intrusiveness, and contributes to the public values of a supervisor. In this manner, supervision becomes a continuous process, that is more effective.

Mutual trust is the basis for establishing and promoting the sharing of data; subsequently, there are conditions for effective data use, which can contribute to a better distribution of roles, responsibilities, and liabilities in supervision. Thus, **Customs data do matter**.

5.2 Limitations

When an attached insider conducts research, bias is inevitable. The bias is this research is recognised, and special attention has been paid to academic rigour from the start, including the applied methodology, triangulation and validation, to avoid compromising the findings of the research.

Non-aligned EU regulations have been researched via classification, a Customs tool for goods identification. The identification if other EU regulations may rely on other systems. Such as the CAS (Chemical Abstracts Service) number for chemical substances or UN numbers (United Nations numbers) for the identification of dangerous goods, towards its transport. From a stakeholder interview with an officer of another supervisor, Groothuis, it appears that classification is inconclusive about these systems as well, with similar effects. As a result, this research as a whole can be generalized to other fields of interest, generalizability applies.

A discussion on the ethical aspects of using technology cannot be ignored. To learn if stakeholders, including the Ministries, the NVWA, the Customs Administration, trade companies, and consumers are ready for the envisaged data usage and its consequences.

5.3 Contributions

This research contributes to knowledge about the use of external data for supervision, identifying effects that can be achieved by applying external data. The theory on external data use on phases where the external data serve as direct input, have been validated. The practical data used are case-based data for food and feed safety supervision on internationally traded goods, obtained from Customs.
Using external data can create better data for better actions, that can be substantiated. Data that more quickly and accurately predict compliance and identify subjects requiring supervision allow for better-attuned actions that prevent overlap, underlap, gaming, and unnecessary inspections.

This research provides insight into how Customs data can be used for the supervision of internationally traded goods, based on food and feed safety supervision from 2017 to 2019. The findings show that the use of external data enhances effectiveness and efficiency, decreases intrusiveness, and contributes to the public values for a supervisor. In addition to food and feed safety, other fields of interest, such as phytosanitary products or consumer products, could benefit from the findings of this research since these fields similarly supervise internationally traded goods. Moreover, others supervisors inside and outside the Netherlands could benefit from this research. All EU member states have the same legal obligation to monitor, and other supervisors may have similar obligation with other risks. However, in an interview, Respondents L pose national differences may occur and should be considered in the use of such data for supervisory purposes.

5.4 Recommendations for future research

This research may inspire additional research; therefore, the researcher recommends follow-up research of the other supervisory domains mentioned in the development of data usage, including experiences, successes, and suggestions for further progress. Moreover, the domain researched is specific, and additional research of other domains can enrich the findings of this research. This invitation for further research especially applies to other EU member states that could benefit from, or currently cooperate with Customs, using external data to supervise internationally traded goods (Chin-A-Fat & van der Steen, 2016). This supervision is most effective when approached on a large-scale via the EU rather than on a smaller national scale, and it might support the war against port-shopping.

According to the literature review, responsiveness is an essential condition for supervision (Ayres b & Braithwaite, 1992). Responsiveness requires flexibility. Notably, the NVWA's intervention policies are not flexible by nature and solely support responses to non-compliance, not responses to compliance. While a positive strategy can better anticipate societal changes (Power, 2004), based on experience (Chapadar, 2020), (Gunningham, 2015). I would recommend research that investigates the possibilities of positive interventions that promote compliance.

Assuming that the NVWA and the Customs Administration are willing to consider the next steps in data sharing, possibly creating a joint data foundation or digital inspection facility, the researcher recommends investigation of organisational forms that support either cooperation or collaboration. Each form has distinct advantages and disadvantages. Cooperation ensures independence of the supervisors while collaboration better addresses the aspect of governance to prevent a crisis that unevenly affects the supervisors and halts or hinders data sharing.

Data quality has a major influence on the extent to which the benefits of data use occur. As the (shared) data use is increasing, and the supporting technology is continuously developing, research in this area is recommended. Towards possibilities to improve the quality of both historical and still to be collected data.

Summary of Chapter 5

The external data use transforms the supervision (sub-question 1) into an enhanced and continuous process when experts give meaning to the data. Supervisory effects can be evaluated (sub-question 2) at micro- macro- or meso level. But measuring is challenging, and claiming causality is difficult with risk-based (selective) supervision. Successful external data use can be explained by factors (sub-question 3), based on their importance and feasibility, trust however, overrides all factors. The NVWA must overcome issues to obtain Customs data (sub-question 4). The data use results (sub-question 5) in more effective, efficient, and less intrusive supervision that better adheres to its public values. Concluding, the external data use enhances the supervision via the effectiveness, efficiency, intrusiveness and adherence to public values; supervision becomes a continuous process. **Customs data do matter**. However, there is room for further improvement when extending and supporting data use.

Despite the limitations of the research, it contributes to envisaged knowledge and practical contribution. The recommendations focus on a follow-up on an international scale, the possibilities of applying positive interventions to promote compliance, the optimal organisational form for future shared data use, and data quality.

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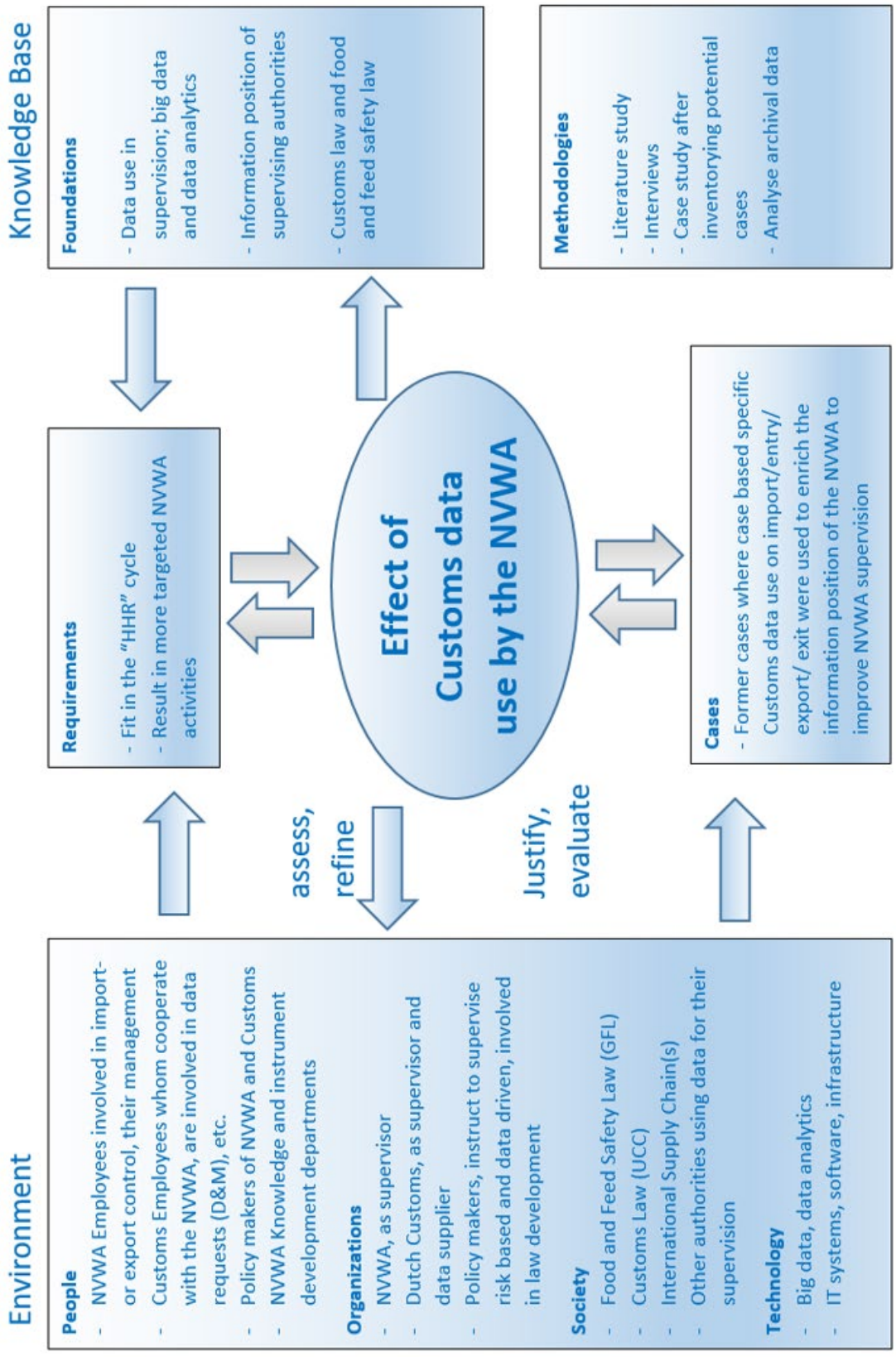
Annex 1: Research framework

FIGURE 9

Research Framework, based on Hevner, March & Park (2004)



Annex 2: Historical overview

The development of food and feed safety supervision on internationally traded goods in the Netherlands, since the year 2000.

TABLE 8

Development of supervision over time

	...in the beginning	Going concern	Now and looking ahead	Future: Joint data use?
Year	2000 - ...	2007 - ...	2018 - ...	?
Supervision NVWA is marked by...	Test products: laboratory samples to test against legal norms. Partly risk based.	Supervising products, more than testing. Supervise on companies too. Both laboratory analysis and documentary checks.	Supervise and enforce risk based and increasingly data driven. Data use gains in complexity. Private quality systems reduce the supervisory burden on companies.	Supervising & enforcing Risk based and data driven in cooperation with other supervisors.
NVWA Mindset	Look for non-compliances, add information to the intelligence and intuition of inspectors.	Exclude trusted traders from supervision scope. Target on non-compliances. Try to be less intrusive when supervising.	Decreased supervision on trusted companies leaves capacity to spend on potential risks and other challenges.	Use technology available to be more efficient and effective. Increase the coverage ratio.
Customs data on...	Import (Sagitta). Biannual buying of statistic and static data on imports (CD from the CBS).	From import (Sagitta) to entry (SBB)	Entry (SBB, DMF), import (AGS-I en GPA), export (AGS-u) and exit (ECS)	All?
Data type	Actual consignments at import	Historical and actual goods, consignments and companies	Supply chains, companies and consignments	Networks, consignments
Complexity	1 database consulted. Data analytic is handwork. Profiling starts.	1-3 databases consulted. Data analytics improves. Better understanding of Customs data. Proper profiling.	1 – many databases, depending on the question. Data analytics requires support of technology. Advanced profiling.	Data pipeline or platform, networks? Advanced data analytics.
Modality	Mainly Maritime	Maritime, Air	Maritime, Air, Post & Courier	All modalities?
Purpose of the data use	Only operational: Prepare for physical inspections, goods physically stopped during import declaration process.	Tactical (T) and operational (O). T: Improve information position and use documents to support supervision. O: Prepare for inspections at EU border/ inland.	Tactical (T) and operational (O). T: Keep information position up to date. O: Prepare for inspections and Inspect based on data.	Strategic, tactical and operational to a lesser content.
Ignited by	Incidents with products, notifications, new or amended legislation.	Introduction of system based supervision.	Supervision develops, increased use of data analytics and behavioral science.	More demanding society. Need to communicate about supervision (Sparrow: Find, solve, communicate).
Need	Known risks, lack of knowledge on logistics: are certain products entering the EU – via NL?	The market and its players not fully in the scope of the NVWA - supply chains are not fully known	Need for combined information from multiple sources. Need for dynamic information rather than historic, static information.	Efficiency and effect
Data go...	One way, from Customs to VWA, on request, occasionally. Per email.	One way, frequently, limited feedback, per email.	One way, more complex data needed, decreased questioning frequency due to limited analytic capacity (NVWA), limited feedback. Indirect secured data exchange.	More than one way, feedback loop. Not exchange but data reuse from a central, secured facility.
Issues	- How to request Customs data on product x? Classification vs goods descriptions. - Scope limited to import	Misaligned legislation: entry and import vs placing on the market	Capacity for data analytics (NVWA) not sufficient for analyzing multiple datasets of bigger volumes with a increased complexity.	Balance between intelligence based on data and intelligence from inspectors

Annex 3: Literature search; as planned and as executed

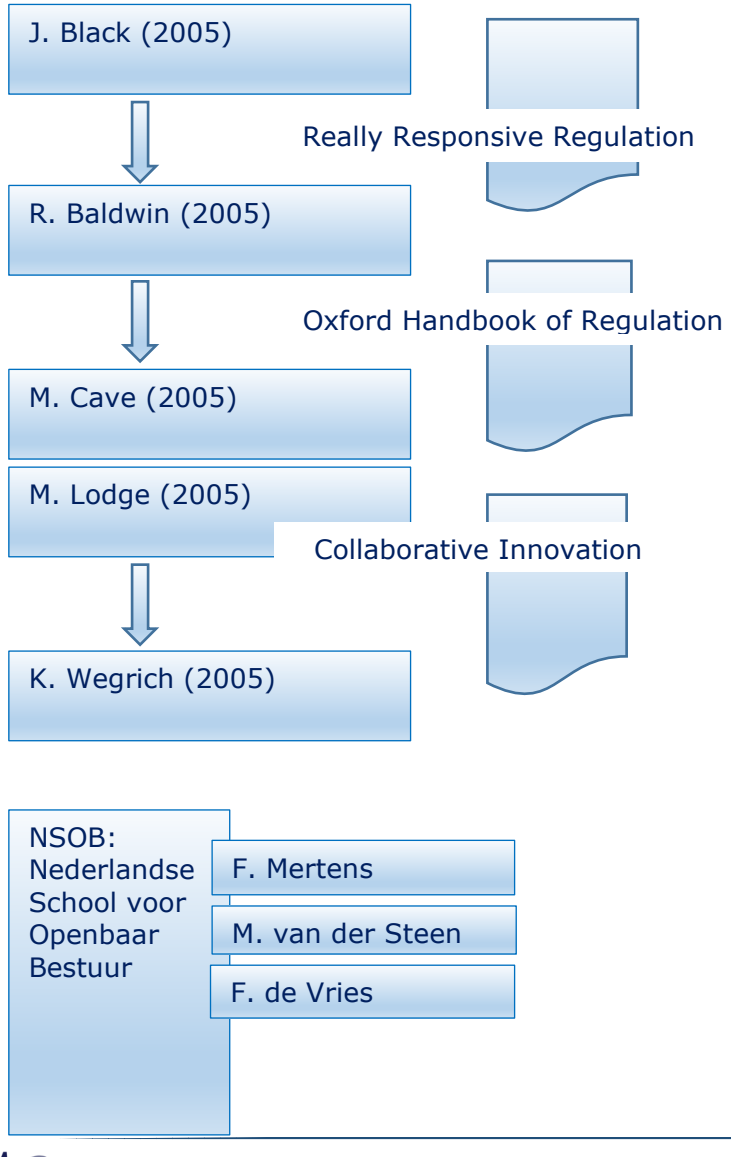
FIGURE 10

Literature Search as planned and as executed

Planned Literature Search

Search terms, English	Search terms, Dutch
Supervision/ Monitoring	Toezicht/ inspecties
Government	Overheidstoezicht
Law (enforcement)	Risicogericht ~
Big data, external data	Data gedreven ~
(shared) data (re)use	Data gebruik
Information sharing	Informatie uitwisseling
Effect, performance	Resultaat/ effect
Cooperation	Samenwerking

Executed Literature search



Annex 4: Customs data

Customs data are collected in different systems because they are related to divergent processes such as entry and import. All Customs processes have their unique characteristics and specificities; so do the associated data. For example, entry data do not hold CN codes; import data are more specific than entry data; and more. Hereafter, the Customs data systems relevant to this research are elaborated, along with their differences and relationships to the Customs processes they support. Moreover, the researcher will further elaborate upon the differences between entry and import. Entry is defined by reaching the territory of the EU/Netherlands while import can only occur afterwards, once goods are introduced into the market of the EU. This information is obtained via stakeholder interviews (Respondent E, F).

Entry: DMF
Before goods enter the EU, they must be declared to Customs by an Entry Summary Declaration. These declarations are digitally processed and stored in the Customs database called the Douane Manifest, which is usually abbreviated by the acronym DMF (Belastingdienst a, 2020). This information is supported via stakeholder interviews (Respondent E, F).

Import: AGS-i and GPA
Non-union goods can become union goods upon finalisation of the declaration for free circulation. The system called the AanGifteSysteem, commonly abbreviated as AGS-i, processes these declarations and data are stored per consignment, regardless of the size of the consignment, whether a single box or multiple containers. Companies that possess a specific license, based on trustworthiness in administrative stock-keeping and capabilities of controlling risks, are allowed to store non-union goods under specific Customs procedures. Based on EU Regulation 952/2013, these Customs' warehouses are allowed for the periodic and automated declaration of free circulation in a simplified manner, using the system called the Geautomatiseerde opgave, or GPA (Belastingdienst b, 2020), (Belastingdienst c, 2020). This information is supported via stakeholder interviews (Respondent E, F).

Export: AGS-u
Goods intended to leave the EU are declared for export, using the system named AGS-u that is comparable to the AGS-i system for imported goods and similarly processes declarations per consignment (Belastingdienst c, 2020). This information is supported via stakeholder interviews (Respondent E, F).

Exit: ECS
Goods declared and released for export physically leave the territory of the Netherlands. Consignments are administered according Customs law in the Export Control System, or ECS, to ensure the export takes place and goods leave the EU as declared (Belastingdienst d, 2020). This information is supported via stakeholder interviews (Respondent E, F).

Transit: NCTS
Goods entering the EU may not necessarily be imports. Other reasons for entry exist, such as providing a bridge until goods are shipped to their final destination. These goods, which enter the EU but are not declared for import, remain under Customs supervision (UCC art. 6.1) and are administered in the New Computerised Transit System or NCTS (Belastingdienst e, 2020). This information is supported via a stakeholder interview (Respondent E).

Venue
Goods entering the EU and bought electronically, can be declared using AGS-I, GPA or using Venue "vooraf de vereenvoudigde aangifte e-commerce doen" until January 1st of 2021. Venue is to be used solely for e-commerce consignments by companies permitted to use Venue (Belastingdienst g, 2020). This information is supported via a stakeholder interview (Respondent E).

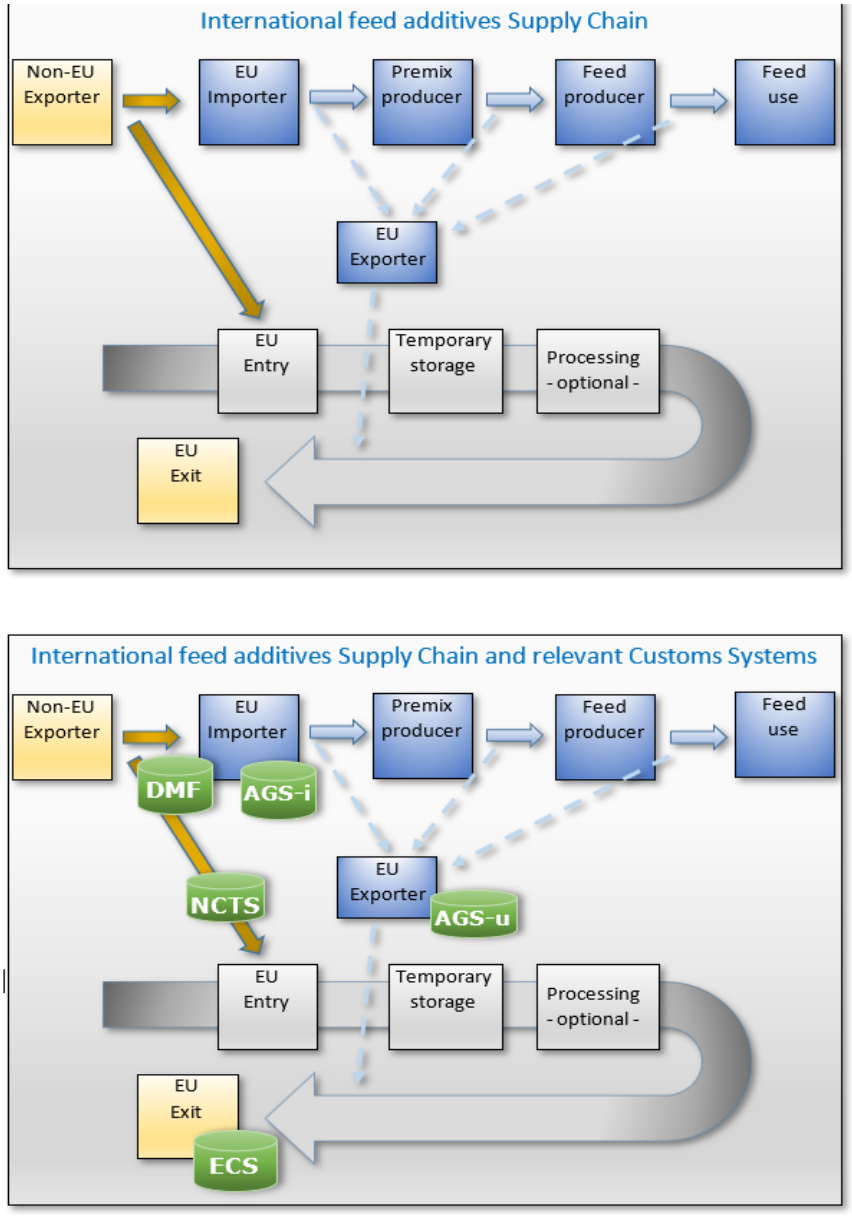
Annex 5: Examples of the use of Customs data

Investigate a supply chain, based on Customs data (data request 21, 22)

Simple data requests from the NVWA to Customs target a product: how to best supervise on a risk in that product, at the moment of entry or import. Increasingly the data requests are more complex, as are the underlying questions. In some cases, the NVWA may have the ambition to gain insight on the supply chain of a certain product: whom are the supply chain parties, what volumes are being dealt with, what modality applies, and with what frequency or patterns?
In the following figure, the feed additive supply chain is presented. All authorised feed additives may enter the EU. But not all products that can be used as a feed additive, are authorised to be consumed or processed in the EU. Some products have a technical purpose too, without legal restrictions. These can enter, the intended purpose does not have to be announced at entry or import. The figure at the top represents a simplified supply chain via supply chain parties and Customs processes. To the figure at the bottom, the Customs data bases are added. To provide an insight in the data required to make the chain intelligible.

Figure 11

Administrative Control on a Supply Chain based on Customs Data

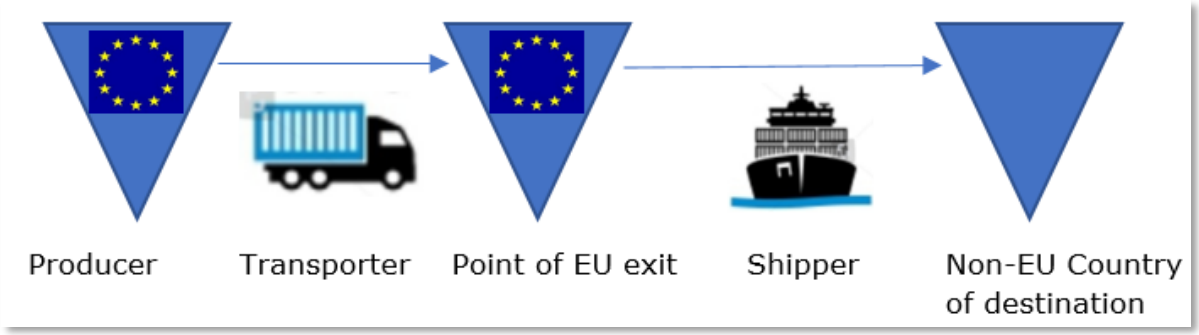


Prove Channelling based on Customs data (data request 23, 24, 25, 33)

In the EU, some products can only be exported under the condition that channelling is provably established. Channelling implies a closed chain from the producer to the point of EU exit in this case. Consignments intended for export must go straight from the place of production to the place of EU exit

FIGURE 12

Simplified scheme of consignments for export, subject to channelling



Every consignment must be notified prior to the start of its transport to that point of EU exit, in the EU application called Traces. At the point of EU exit, it must be established if the prior notified container actually leaves the EU, with the prior notified seal still on it. Channelling aims that no consignments get 'lost' after leaving the producers premises: consignments travel the planned transport route and leave as prior notified.

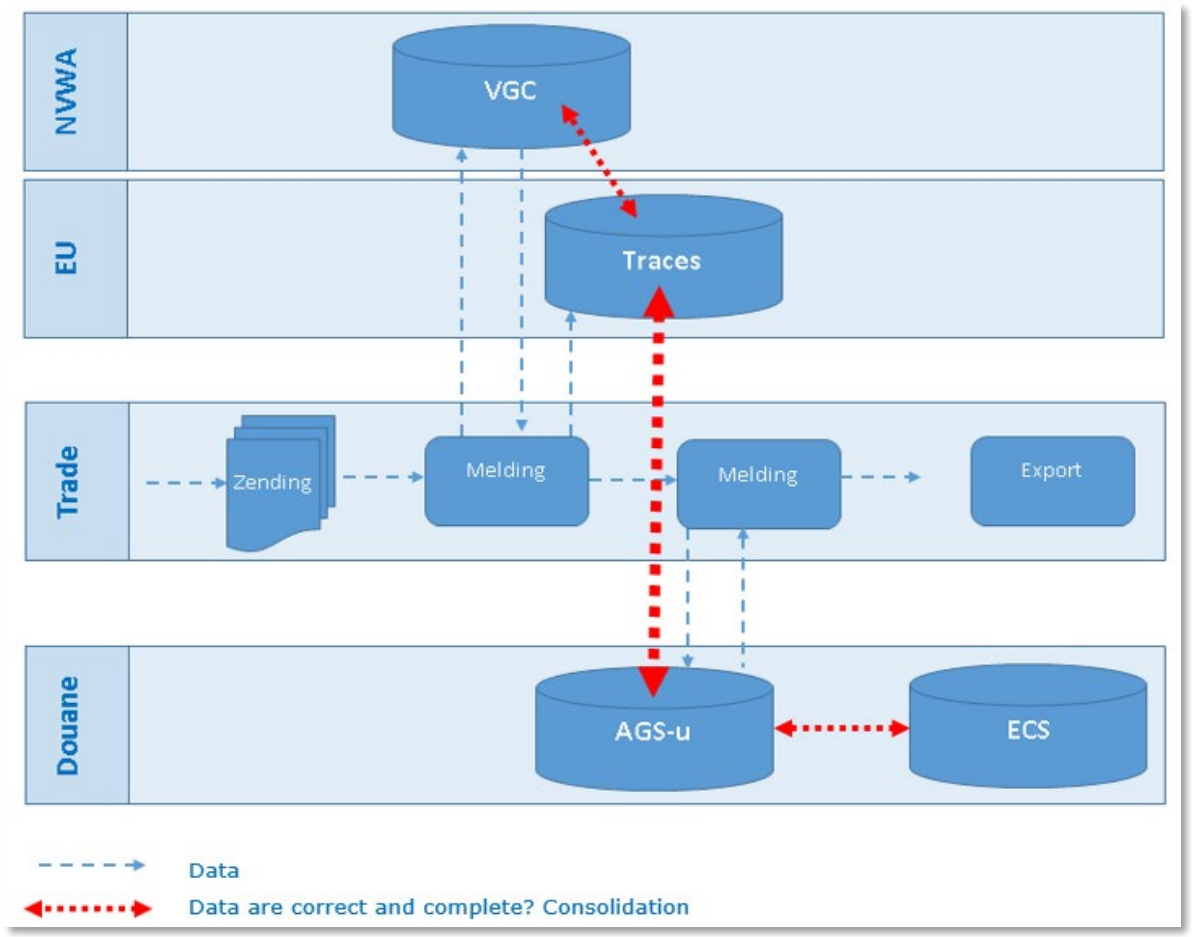
Checks at the EU point of exit must be performed on every single consignment (100%) unless the EU member state can substantiate that a part needs to be checked physically. The Netherlands rather than inspecting all exported consignments, over 8,000 annually, applies a sample. To substantiated the partial inspections, the NVWA checks all prior notified consignments applying administrative checks. From that checks it appears that the channelling the regulation intends to achieve, in practice is achieved. The NVWA has proven that based on all consignment prior notified in TRACES in 2018, using Customs data. Comparing Traces data with ECS and AGS-u data.

Terminals in the Port of Rotterdam all have a status as temporary storage facility. One of the conditions for that status is that terminals control their incoming and outgoing flow. Checks on incoming containers and a balanced and reliable administration are part of the conditions. Customs supervises again upon the terminals. Moreover, Customs supervises the process of export and exit. Hence has information on all containers that leave the EU. One of the purposes being to establish no consignments get lost, during customs procedures.

The figure on the following page presents the data sources used during this process.

FIGURE 13

Data Sources on the Export of Consignments, subject to Channelling



Annex 6: Issues with Data Requests

TABLE 9

Listing and explanation of Issues when requesting Customs Data for the Supervision

Term in case descriptions	Description of the issue
Time to build AGS history	Recent data matter, for divergent reasons. For instance: When the official control regime changes, trade may anticipate by changing behavior to evade controls. Or when findings from inspections need to be verified to established if non- compliance is at stake. When inspection aims to address non-compliance real time; a rapid response positively influences the effect of interventions. In case of EU signals such as RIF, RASFF, RAPEX notifications on actual risks that must be taken care of. Outdated data means that risky products may already be distributed, sold or even consumed *(EU b, 2019)*. Occurred with data request nr. 1-4, 7-12, 16-20, 25, 30, 31, 34.
Goods description	The information on goods derived from customs data are usually general. Is the goods description of declarations specific enough to clearly identify targeted products? Do the goods descriptions hold information on the destination of a product, such as "food use" or "feed use"? That level of information is not mandatory for a customs declaration. But may be necessary to find the potentially risky products. There is no incentive for a Customs declarant to put such details in a declaration. Occurred with data request nr. 1, 2, 6-9, 12, 14-23, 34.
NVWA data processing capacity	The NVWA capacity to prepare data and give meaning to them, is limited. Especially with larger data sets or in the holiday season this may hinder a rapid processing of data sets. Not all risks can bare that kind of delay. Occurred with data request nr. 4, 6, 10, 11, 20-23.
KvK ≠ EORI	To identify importers, Customs uses EORI numbers – that relate to Dutch companies or companies from other countries. The NVWA relies on KvK numbers, that can identify Dutch companies. To bridge the difference, data request may rely on addresses that are possibly used. But the address is not a mandatory data element in all declarations. Moreover, type writing errors in the names or addresses may occur. That would prevent signaling consignments. Occurred with data request nr. 1, 3-4, 9, 16, 21-22, 31.
Classification	The classification has a certain purpose and structure. That may not align with how other supervisors view products. See also the case study on Classification, a part of this research. Occurred with data request nr. 6, 12, 21, 31.
Food and feed overlap	Products may be intended for food or feed use. Or may be imported without stating the intended use, such information is not mandatory to provide when declaring goods. Such purpose does not matter for Customs, it does to other supervisors that aim to tackle other risks. Occurred with data request nr. 20-22, 25, 30, 31, 34.
Data quality	Relying on data that were collected for another purpose may imply that the data quality is not sufficient. Details that are not interesting to the purpose

	of the administration are just the details that can make the difference in other cases. Occurred with data request nr. 11, 14, 23, 24.
Incomplete without NCTS	Goods that enter the EU are not necessarily to be found in the declarations for entry or for free circulation: they may move elsewhere and remain unseen in declaration data. Occurred with data request nr. 14, 21, 22.
Network	Within the NVWA and between Customs and the NVWA, work is done by humans. It requires a network to operate smoothly, efficient and effective. But finding the right person is not always easy. The available phone lists do not suffice for all issues where the right person for a certain problem is sought. Occurred with data request nr. 4.
Communication	The quality of communication matters to address issues as efficient and effective as possible. Fuzzy messaging causes blur, time lost and noise in the process. Occurred with data request nr. 10.
Non-aligned EU law	Where a goods description may suffice for the Customs law, it may not align with law that sees upon other risks. Occurred with data request nr. 31.

Annex 7: Result of coding all Data Requests

The following table presents the result of coding all data requests.

TABLE 10

Result of coding of all Data Requests

Request Nr.	**Purpose of the request** (1.1 - 1.7)	**Data requested** (2.1 - 2.7)	**Risk indicators** (2.10-2.14)	**Problems** (3.1- 3.4)	**Data analysis NVWA** (4.1, 4.2)	**Evalua-tion of the data use** (5.1, 5.2)	**Effects on follow up** (6.1-6.6)	**Effect: findings** (7.1-7.2, 7.11, 7.21, 7.31, 7.41)
1	1.2	2.1	2.10, 2.11	3.2, 3.3	4.2	5.1	6.1	7.1, 7.21
2	1.3	2.1, 2.5	2.11, 2.14	3.2, 3.3	4.2	5.1	6.2	7.2, 7.41
3	1.2	2.1	2.10	3.2, 3.3	4.2	5.1	6.1	7.1, 7.21
4	1.2	2.1, 2.5	2.10	3.1, 3.2, 3.3, 3.4	4.2	5.1	6.2	7.1, 7.21
6	1.7	2.1, 2.5	2.11	3.2, 3.4	4.2	5.1	6.5	7.2
7	1.2	2.1	2.11, 2.14.	3.2, 3.3	4.2	5.1	6.2	7.1
8	1.2	2.1, 2.2, 2.3	2.10, 2.11	3.2, 3.3	4.2	5.1	6.1	7.1, 7.21
9	1.2	2.1, 2.5	2.10	3.2, 3.3	4.2	5.1	6.2	7.1
10	1.3	None	2.10, 2.13	3.1 ,3.2, 3.3, 3.4	4.2	5.1	6.3	7.1, 7.21, 7.31, 7.41
11	1.3	Other	2.10, 2.11, 2.12, 2.13	3.2, 3.3, 3.4	4.2	5.1	6.2	7.1, 7.2, 7.31, 7.41
12	1.7	2.1, 2.5	2.11	3.2, 3.3	4.2	5.1	6.5	7.21
14	1.2	2.1, 2.3	2.10, 2.12	3.2	4.2	5.1	6.2	7.1
15	1.3	2.3	2.11	3.2	4.2	5.1	6.2	7.1, 7.2, 7.41
16	1.3	2.1, 2.3	2.10	3.2, 3.3	4.2	5.1	6.2	7.1, 7.2
17	1.2	2.1, 2.7	2.11, 2.14	3.2, 3.3	4.2	5.1	6.1	
18	1.4	2.1	2.11	3.2, 3.3	4.2	5.1	6.2	7.1, 7.2, 7.11, 7.21
19	1.3	2.1, 2.5	2.11	3.2, 3.3	4.2	5.1	6.2	7.1, 7.2, 7.21, 7.41
20	1.3	2.1, 2.5	2.10	3.2, 3.3, 3.4	4.2	5.1	6.5	7.11
21	1.3	2.1, 2.2, 2.3, 2.4	2.10	3.2, 3.4	4.2	5.2	6.6	7.1
23	1.4	2.2, 2.4	2.10, 2.11, 2.12, 2.13, 2.14	3.2, 3.4	4.2	5.1	6.4	7.1, 7.2, 7.21, 7.41
24	1.4	2.2, 2.4	2.10, 2.11, 2.12, 2.13, 2.14	3.2	4.2	5.1	6.4	7.1, 7.2, 7.21, 7.41
25	1.4	2.2, 2.4	2.10, 2.11, 2.12, 2.13, 2.14	3.2, 3.3	4.2	5.1	6.4	7.21
31	1.3	2.1, 2.5	2.11	3.2, 3.3	4.2	5.1	6.2	7.1, 7.11, 7.21
34	1.2	2.1, 2.3	2.10, 2.11, 2.14	3.2, 3.3	4.2	5.1	6.3	7.1, 7.2, 7.21, 7.31, 7.41