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Appendix 2 – Country Reports

Contact:
Kerstin Borg, +46 (0)10-240 40 63

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1. Finlands landrapport

Erik Schyberg

Crismart, Försvarshögskolan

1.1 Generell översikt

Grunden för Finlands försörjningsberedskap spänner över flera dokument, strategier och lagar. Försörjningsberedskap är en del av Finlands officiella säkerhetsstrategi[1] och landets regering fastställer även målen med Finlands försörjningsberedskap ungefär vart femte år.[2,] vilket senast skedde i december 2013.[3] Med försörjningsberedskap menas tryggande av befolkningens utkomst, landets näringsliv och den produktion, service och infrastruktur som är nödvändig för landets försvar i situationer med allvarliga störningar och i undantagsförhållanden.[4] Vid sidan av materiell beredskap, som säkerhetsupplagring, har kontinuitetshantering i försörjningsviktiga organisationer och nätverk fått en viktigare roll i Finland under 2000-talet.[5]

Målet för försörjningsberedskapsarbetet är att de mest allvarliga kriserna ska kunna hanteras med nationella åtgärder.[6] Traditionellt sett har Finlands försörjningsberedskap präglats av en strävan efter självförsörjning i hög grad.[7] Denna syn är fortfarande aktuell men har idag utökats med en förståelse om att internationella kontakter, flöden och nätverk är viktiga och att Finland inte kan se sig enbart som en ”isolerad önation”.[8] Enligt regeringens mål för försörjningsberedskapen är utgångspunkterna en välfungerande internationell marknad, en diversifierad industri, stabila offentliga finanser och en konkurrenskraftig samhällsekonomi. Det internationella nätverket är viktigt; internationellt samarbete anses komplettera nationella beredskapsåtgärder.[9] Samarbeten av vikt är t.ex. EU:s solidaritetsprincip och avtalet om ett internationellt energiprogram.[10] En utgångspunkt för försörjningsberedskapen är att EU:s inre marknad fungerar.[11]

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[1] Försvarsministeriet, 2010.
[2] Arbets- och näringsministeriet, 2012.
[3] Statsrådets beslut 857/2013, s. 1.
[4] Statsrådets beslut 857/2013, s. 1.
[5] FBC, 2013, Försörjningsberedskap i Finland.
[6] Statsrådets beslut 857/2013, s. 1.
[7] Aaltola et. al, s. 151.
[8] Aaltola et. al, s.159.
[9] Statsrådets beslut 857/2013, s. 1.
[10] Statsrådets beslut 857/2013, s. 1.
[11] Statsrådets beslut 857/2013, s. 2.

Företagens deltagande i beredskapsplaneringen har ett starkt stöd i näringslivet. Vissa sektorer har genom lag skyldighet att hålla viss beredskap. Till dessa hör datakommunikation, trafik, energi- och finanssektorerna. Privat-offentlig samverkan har i strategin blivit viktigare än tidigare för att upprätthålla beredskap.[12]

Försörjningsberedskap innebär för Finland att ett antal samhällsviktiga områden ska tryggas. Enligt regeringens mål är dessa den väsentliga infrastrukturen, energisektorn, informations- och kommunikationssystem, finanssektorn, transporter, vatten- och livsmedelsförsörjning, underhållskapacitet, hälsovård och produktion och tjänster för att stödja det militära försvaret.[13] I målen anges också nivån på landets säkerhetslager.[14] Finlands regering ser olika hot mot samhällets försörjning: allvarliga störningar mot befolkningens hälsa och funktionsförmåga, samt natur- och miljökatastrofer. Det allvarligaste externa hotet mot samhällets försörjning vore om viktig inhemsk produktion eller viktig import tillfälligt försvåras.[15]

En utmaning för försörjningsberedskapen är att nätbaserade datasystem blir allt känsligare för störningar. Om dessa system och eldistributionen slutar att fungera drabbas samhället mycket hårt och snabbt.[16]

1.1.1 Lagstiftning

Det finns flera lagar som reglerar Finlands försörjningsberedskap. En central lag är Beredskapslagen (1552/2011) från 2011,[17] som ersatte den tidigare lagen från 1991. Beredskapslagen (1552/2011) ger finska myndigheter befogenheter under s.k. ”undantagsförhållanden” och reglerar även myndigheternas befogenheter inför sådana händelser.[18] Ett undantagsförhållande kan införas under följande omständigheter: Ett väpnat angrepp eller ett hot om väpnat angrepp, allvarliga händelser eller hot som innebär en risk för samhällets vitala funktioner, en synnerligen allvarlig storolycka, eller en pandemi som kan räknas som en storolycka.[19]

Beredskapslagen (1552/2011) syftar till att skydda befolkningen och trygga landets försörjning, närmare bestämt ”skydda befolkningens försörjning och landets näringsliv, upprätthålla rättsordningen, de grundläggande fri- och rättigheterna och de mänskliga rättigheterna samt trygga rikets territoriella

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[12] Försvarsministeriet, 2010, ss. 8-9.
[13] Statsrådets beslut 857/2013.
[14] Statsrådets beslut 857/2013, s. 10.
[15] Statsrådets beslut 857/2013, s. 1.
[16] Investera och äga, 2009.
[17] Beredskapslag (1552/2011).
[18] Beredskapslag (1552/2011) 2§.
[19] Beredskapslag (1552/2011) 3§.

integritet och självständighet."[20] Regeringen beslutar tillsammans med landets president om undantagsförhållande råder i landet. Regeringen kan därefter genom en förordning tillämpa lagen, en så kallad ibruktagningsförordning, högst under sex månader.[21] Myndigheter får endast använda de befogenheter som lagen erbjuder om det inte finns några andra alternativ.[22] Statliga myndigheter, affärsverk, kommuner och samkommuner är skyldiga säkerställa att de kan sköta sina uppgifter så mycket det går även under undantagsförhållanden.[23]

Under undantagsförhållanden kan privata aktörer tvingas till vissa åtgärder för att uppfylla lagens syfte. Jordbruket kan behöva särskilda inköpstillstånd för bl.a. gödsel, bekämpningsmedel, foder, drivmedel och djurläkemedel. Inköparna får dessutom enbart använda sådana produkter för åtgärder som tryggar livsmedelsproduktionen.[24] Även konsumenter inom detaljhandeln kan behöva inköpstillstånd för varor som anses viktiga för befolkningens försörjning. [25] Annan handel kan också regleras med inköpstillstånd.[26] Regeringen reglerar genom förordning vilka produkter som berörs av inköpstillstånd. Prisreglering inom detaljhandeln, el- och bränslehandeln kan införas genom förordning.[27]

En näringsidkare kan under undantagsförhållande tvingas att informera myndigheter om vissa producerade varors efterfrågan och pris.[28] Regeringen kan också genom förordning styra hur näringsidkare ska tillhandahålla varor och tjänster till andra näringsidkare och offentliga samfund.[29] Vissa produkter kan vid behov behöva överlämnas till Försvarsmakten för att upprätthålla försvarsberedskapen. Företag m.fl. kan åläggas att tillhandahålla behövda tjänster.[30] Regeringen kan förordra hur viktiga produkter ska användas i industriproduktionen, t.ex. metaller, kemikalier, läkemedel, jordbruksprodukter och bränslen.[31]

Regeringen kan reglera utrikeshandeln genom att bestämma att vissa produkter endast får föras ut ur landet om statsrådet har gett sitt godkännande.

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[20] Beredskapslag (1552/2011) 1§.
[21] Beredskapslag (1552/2011) 6§.
[22] Beredskapslag (1552/2011) 4§.
[23] Beredskapslag (1552/2011) 12§.
[24] Beredskapslag (1552/2011) 31§.
[25] Beredskapslag (1552/2011) 32§.
[26] Beredskapslag (1552/2011) 33§.
[27] Beredskapslag (1552/2011) 43§.
[28] Beredskapslag (1552/2011) 29§.
[29] Beredskapslag (1552/2011) 33§.
[30] Beredskapslag (1552/2011) 110§.
[31] Beredskapslag (1552/2011) 34§.

Totalt utförselförbud för vissa produkter kan införas. Förbud mot att föra in varor i landet kan utfärdas om tidigare åtgärder inte räcker för samhällets säkerhet, eller om det finns risk för skada eller marknadsstörningar inom en viss näring.[32] Även el- och bränsleförsörjningen kan begränsas och prioriteras.[33]

En annan viktig lag är Lagen (1390/1992) om tryggande av försörjningsberedskapen som bl.a. reglerar statens säkerhetsupplagring. I dessa lager ska lagring ske av samhällsviktiga råvaror och produkter. Syftet är kunna trygga befolkningens utkomst, näringslivet och försvaret. Dessutom ska sådana produkter lagras som förpliktelser genom internationella avtal om försörjningsberedskap.[34] Lagen (979/2008) om obligatorisk lagring av läkemedel reglerar lagring av läkemedel ur ett försörjningsberedskapsperspektiv.[35]

1.1.2 Centrala myndigheter och aktörer

Arbets- och näringsministeriet har ett helhetsansvar för att samordna och utveckla försörjningsberedskapen i Finland. Varje ministerium ska dock utveckla beredskapen inom sitt eget ansvarsområde.[36] Staten och kommuner har lagkrav på sig att vidta förebyggande beredskapsåtgärder, t.ex. genom beredskapsplaner. Finlands modell för försörjningsberedskap bygger på privat-offentligt samarbete.[37]

Myndigheten Försörjningsberedskapscentralen (FBC) är central och bedriver planering och operativt arbete inom området för utveckling och upprätthållande av landets försörjningsberedskap.[38] FBC utvecklar privat-offentlig samverkan i frågor som gäller försörjningsberedskapen, säkerställer funktionen hos viktiga tekniska system, tryggar samhällsviktig produktion och produktion som stöder det militära försvaret samt sköter säkerhetsupplagring.[39] FBC ansvarar även för Organisationskommittén för egen beredskap i hushållen. Kommittén främjar individers beredskap att agera på egen hand och vara självförsörjande under en kortare tid vid störningssituationer. Två ickestatliga organisationer som deltar i kommitténs verksamhet är Marthaförbundet och Trädgårdsförbundet.[40] Portalen HUOVI,

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[32] Beredskapslag (1552/2011) 35§.
[33] Beredskapslag (1552/2011) 36-42§.
[34] Lag (1390/1992) om tryggande av försörjningsberedskapen 3§.
[35] Lag (979/2008) om obligatorisk lagring av läkemedel.
[36] Statsrådets beslut 857/2013.
[37] FBC, 2013, Försörjningsberedskap i Finland.
[38] Statsrådets beslut 857/2013, s 1.
[39] Lag (1390/1992) om tryggande av försörjningsberedskapen 6§.
[40] Fjäder, Christian. E-post 2015-09-03.

för informations- och kontinuitetshantering, samt projektet SOPIVA, avtalsbaserad beredskap, är redskap som finns tillgängliga från FBC.[41]

FBC utgör tillsammans med Försörjningsberedskapsrådet och sektorer och pooler Försörjningsberedskapsorganisationen.[42] Försörjningsberedskapsrådet upprätthåller kontakterna med de viktigaste samarbetsparterna, övervakar områdets utveckling och lägger fram åtgärdsförslag.[43] En sektor är en samarbetsorganisation inom en specifik bransch och utgörs av företag, organisationer och myndigheter. En pool är ett operativt organ som leds av näringslivet. De planerar utvecklingen av försörjningsberedskapen i en bransch och väljer ut samhällsviktiga företag i en bransch. Målen för poolerna sätts upp av sektorerna.[44]

Tillsammans med Säkerhetskommittén, myndigheter, företag och organisationer samlar FBC in information om samhällsviktig verksamhet med avgörande betydelse för försörjningsberedskapen. Även hotbedömningar görs.[45] Analys och kunskap om globala och nationella flöden är viktigt. I de allmänna målen prioriteras informations- och kommunikationssystem, elförsörjning och leveranssäkerhet samt tillgång till alternativa leveranskällor.[46] FBC förvaltar även försörjningsberedskapsfonden[47] som bekostas med avgifter på el och bränsle. Fonden finansierar säkerhetsupplagen, tekniska reservarrangemang, tryggande av kritisk infrastruktur och viss beredskapsplanering. I nuläget är fondens avkastning av avgifterna drygt 45 miljoner euro per år. Tillgångarna via skatteintäkter har minskat p.g.a. sjunkande bränslepriser.[48]

FBC:s verksamhet utvärderades 2012 på uppdrag av Arbets-och näringsministeriet (ej offentlig rapport). Utvärderingen gjordes i samband med att regeringen skulle sätta upp nya mål för försörjningsberedskapen. FBC ansågs vara bra på att koordinera samarbetet mellan den offentliga sektorn och näringslivet och ansågs upprätthålla en god beredskap med många olika typer av kriser i åtanke. Utredningen slog dock även fast att myndigheten måste utveckla sitt arbete för att vara mer anpassad till förändrade förutsättningar. Arbets-och näringsministeriet behövde bl.a. göra styrningen av FBC mer

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[41] FBC, 2013, Kontinuitetshantering.
[42] Statsrådets beslut 857/2013, s 1.
[43] Lag (1390/1992) om tryggande av försörjningsberedskapen 8 c §.
[44] Lag (1390/1992) om tryggande av försörjningsberedskapen 8 d §; FBC, 2013, Partnersamarbete mellan den privata och offentliga sektorn.
[45] Statsrådets beslut 857/2013, s 2.
[46] Statsrådets beslut 857/2013, s 2.
[47] Lag (1390/1992) om tryggande av försörjningsberedskapen 8§.
[48] Statens budgetpropositioner, 2015; Lag (1390/1992) om tryggande av försörjningsberedskapen 11§.

systematisk och öka målorientering.[49] I nuläget ser FBC:s ledning inga akuta hot mot Finlands försörjningsberedskap men händelserna i Ukraina ses som en anledning för att undersöka olika scenarion och handlingsutrymmen.[50]

I Finland ansågs under 2009 att ett par tusen företag var viktiga för försörjningsberedskapen. Flera hundra av dem ingår i den särskilda organisationen för försörjningsberedskap genom avtal. Samarbetet är uppdelat i fem sektorer och 24 samarbetspooler. Finland har starkt inhemskt ägande inom samhällsviktiga områden, något som ses som ett komplement till lagstiftning och planering inom försörjningsberedskapen. Under 2009 ansågs det dock att det kunde behövas en övervägning om allt ägande var motiverat ur beredskapssyfte.[51]

1.2 Livsmedel- och vattenförsörjning

I Finland konsumeras till största delen inhemska livsmedel.[52] År 2008 producerades 75 procent av all mat som såldes i Finland inom landet. Livsmedelsproduktionen grundade sig huvudsakligen på inhemska produkter men importberoendet hade ökat de senaste tio åren. Den importerade matens andel ansågs av regeringen ännu inte vara särskilt stor men ökande. Följande importprodukter var viktigast: Alkoholdrycker, frukt, kaffe, ost, grönsaker, färsk fisk, fetter och oljor, modifierad stärkelse, fiskkonserver, oljefrö, choklad och saft.[53]

Livsmedelsproduktionen har centraliserats genom färre men större gårdar, samt genom en geografisk centralisering. Djuruppfödningen sker i högre grad genom nätverk med ökade transporter mellan gårdarna. Livsmedelsförädlingen är också centraliserad till ett antal få anläggningar, som andel av förädlingen. Däremot nämns också att över 90 % av antalet förädlingsanläggningar är små eller medelstora. Multinationella företag ökar sin andel av försäljningen. Regeringen ser en risk i en ökande nätverksbaserad produktion, som bl.a. innebär ett uppdelat och därmed mindre tydligt enskilt ansvar för hela livsmedelskedjan, även om nätverksformatet också har positiva konsekvenser.[54]

Tryggande av vatten- och livsmedelsförsörjningen ingår i Finlands säkerhetsstrategi som en av flera vitala funktioner att trygga för samhället.

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[49] Arbets- och näringsministeriet, 2012.

[50] FBC, 2014, Ledningens översikt.

[51] Investera och äga, 2009.

[52] Statsrådets redogörelse om livsmedelssäkerheten 2013–2017, s. 32.

[53] Statsrådets redogörelse om livsmedelssäkerheten 2013–2017, s. 34.

[54] Statsrådets redogörelse om livsmedelssäkerheten 2013–2017, s. 34.

Självförsörjning är en uttalad del av strategin. Lantbruket ska producera tillräckligt med råvaror för att livsmedels- och foderindustrin, i kombination med säkerhetslagring av bl.a. spannmål och tillgång till nödvändiga importerade produkter, i sin tur ska kunna producera den mängd livsmedel som kan anses som normalkonsumtion i landet.[55] Detta ska uppnås genom att Finland inom EU arbetar för att förutsättningarna för lönsamt jordbruk ska finnas även i de nordliga delarna av Europa. Tillgången till importerade produkter tryggas genom internationella fördrag med andra nordiska länder och andra länder inom EU. Lantbrukens självförsörjning av energi ska främjas. Logistiken inom hela livsmedelssystemet ska tryggas. Under en störningssituation kommer produktionen att styras av bl.a. jord- och skogsbruksministeriet, arbets- och näringsministeriet, Landsbygdsverket samt kommunernas landsbygdsnäringssekreterare. Dessa myndigheter ansvarar också för eventuell ransonering. Säkerhetslager ska finnas.[56]

Lagstiftningen ska utvecklas för att stärka beredskapen inom vattenförsörjningen. Praktiska utvecklingsåtgärder som planeras är kommunikation, samarbete mellan myndigheter och beredskapsplanering. Ansvaret för utvecklingen och för tryggandet av vattenförsörjningen ligger inom social- och hälsovårdsministeriets förvaltningsområde.[57] I regeringens mål med försörjningsberedskapen ska samhällsviktiga vattendistributörer säkerställa ”kontinuiteten” i verksamheten och tillgången till alternativa vattenkällor. Vattenförsörjning av hög kvalitet anses nödvändig för både befolkningen och näringslivet. Vattenverken ska förbättra sin driftsäkerhet och kommunerna samordnar och utvecklar beredskapen. Försörjningsberedskapsorganisationen samordnar arbetet med annan ”regional och lokal verksamhet”.[58] I lagstiftningen kan vattenförsörjningen regleras genom beslut av jord- och skogsbruksministeriet. Vattendistributörerna kan då behöva distribuera vatten till andra områden än de vanliga och rätten till vattentäkt kan ändras om detta behövs för att trygga samhällets vattenförsörjning.[59]

Lagring av livsmedel regleras i Lagen (1390/1992) om tryggande av försörjningsberedskapen. Enlig lagen ska samhällsviktiga råvaror och produkter lagras. De specifika mängderna och vilka råvaror och produkter det rör sig om fastställs i regeringens mål för försörjningsberedskapen.[60] Målen med livsmedelsförsörjningen är att mångsidighet och tillräcklig nivå på primärproduktionen ska säkras, liksom råvaruförädlingen. Här är inflytande

[55] Försvarsministeriet, 2010, s. 40, s. 44.
[56] Försvarsministeriet, 2010,, s 44.
[57] Försvarsministeriet, 2010, s 45.
[58] Statsrådets beslut 857/2013, s.7.
[59] Beredskapslag (1552/2011) 44§.
[60] Lag (1390/1992) om tryggande av försörjningsberedskapen 3§.

över EU:s jordbrukspolitik viktigt för att kunna trygga en tillräcklig inhemsk primärproduktion.[61] Finland ska lagra sex månaders förbrukning av spannmål som människoföda, samt frön och andra nödvändiga varor för att primärproduktionen ska vara säkrad.[62] Tidigare mål från 2002 krävde ett helt års lagring.[63] Kommunerna ansvarar för att deras måltidstjänster ska kunna hantera allvarliga störningar, där kontinuitetskontroll är ett viktigt verktyg i produktionen.[64]

Säkerhetsupplagen har använts under skarpa händelser. Under 2013 beslutade Finlands regering att använda landets säkerhetsupplag då extremt väder orsakade utsädesbrist. Runt 9 000 ton utsäde såldes till aktörer inom utsädessektorn. Det underströks att användningen genomfördes enligt Lagen (1390/1992) om tryggande av försörjningsberedskapen och inte var ett sätt att minska vanliga risker i en affärsverksamhet. Regeringen hade tidigare tagit utsädeslagren i bruk under 2005.[65]

1.2.1 Strategier inför framtiden

En nationell livsmedelsstrategi upprättades under 2010, med ett långt strategiskt perspektiv som sträcker sig till 2030. Även där ses grunden för försörjningsberedskapen vara ett konkurrenskraftigt livsmedelssystem, inkluderat en tillräcklig inhemsk jordbruksproduktion. Ett fungerande jordbruk och förädlingsindustri är en viktig punkt. För detta krävs en politik för lönsam verksamhet inom jordbruk och förädling samt tillräcklig infrastruktur och service på landsbygden. Både offentliga och privata aktörer ansvarar för detta. Utöver det ses en fungerande handel, infrastruktur, datakommunikationer samt tillgång till energi, vatten och tjänster i systemet som viktigt. En viktig insyn är att produktionskedjan är beroende av internationell handel, trots hög självförsörjning. Det behövs också en koppling till världsmarknaden och möjlighet att samarbeta med flera olika leverantörer. Beroende av importerat foder bör minskas genom ökad egen produktion.[66]

Självförsörjningen av foderprotein ska öka från 15 procent till 50 procent genom utveckling och investering i t.ex. bioenergi. Jordbrukets beroende av importerad energi ska minska med 50 procent genom fortsatta energiprogram och eventuellt biobränsleproduktion. En mer decentraliserad lagring bör

[61] Statsrådets beslut 857/2013, s.7.
[62] Statsrådets beslut 857/2013, s.8.
[63] Statsrådets beslut 350/2002.
[64] Statsrådets beslut 857/2013, s.8.
[65] Arbets-och näringsministeriet, 2013.
[66] Ledningsgruppen för beredning av livsmedelsstrategin, 2010, s. 16-17.

utredas. Både offentliga och privata aktörer, inklusive forskningen, är ansvariga.[67]

Även produkter för att framställa gödsel och andra viktiga varor ska lagras enligt denna strategi. Växtförädling och utsädesproduktion ska få stöd av FBC. Ansvaret för en god växtförädling ligger hos jordbruksförvaltningen och forskningen inom området. Växtförädlingen behöver utvecklas och bioteknik anses som ett nödvändigt redskap, i synnerhet i ett långsiktigt perspektiv då tekniken kommer att utvecklas fram till 2030. Sådan teknik måste vara transparent och tillgänglig och inte enbart en tillgång för ett begränsat antal internationella företag. Möjligheten att använda genmodifierade produkter ska säkras, samtidigt som det är viktigt med tillgång till vetenskaplig expertis för att kunna bedöma genteknikens konsekvenser. Detta ska kunna garanteras på nationell och EU-nivå. I slutorden konstateras att livsmedelssektorn är dynamisk och i konstant förändring, vilket kräver en kontinuerlig uppdatering av strategin.[68]

1.3 Läkemedel

Social- och hälsovårdsministeriet leder, övervakar och samordnar förberedelser för exceptionella situationer och undantagsförhållanden inom sitt förvaltningsområde för att säkerställa en sund livsmiljö, god hälsa och befolkningens funktionsförmåga. Ministeriets beredskapsenhet svarar för situationslednings- och säkerhetsarrangemang. Dess centrala uppgifter är: leda förberedelser, utveckla situationslednings- och aktionsberedskapen, utveckla säkerhetsutbildning i samarbete med övriga myndigheter, oftast med FBC, internationellt samarbete samt sakkunnig- och samordningsuppgifter i fråga om civil krishantering.[69] Enligt Regeringens nuvarande mål med försörjningsberedskapen inom området för läkemedel ska Social- och hälsovårdsministeriet ansvara för utveckling av lager av de viktigaste läkemedlen för undantagsförhållanden. Ministeriet ska också, med stöd av FBC, ge ut anvisningar för utveckling av kontinuitetsplanering inom hälsovården. [70]

Inom försörjningsberedskapssystemet finns privat-offentliga samarbetsorgan i form av en hälsovårdssektor och en hälsovårdspool. Sektorns ordförande är Social- och hälsovårdsministeriets kanslichef. Poolens ordförande är

[67] Ledningsgruppen för beredning av livsmedelsstrategin, 2010, s. 17.
[68] Ledningsgruppen för beredning av livsmedelsstrategin, 2010, s. 16-17.
[69] Fjäder, Christian. E-post 2015-09-03.
[70] Statsrådets beslut 857/2013, s.8.

logistikdirektören för Helsingfors universitetsjukhus. Både sektorn och poolen har medlemmar från den offentliga förvaltningen och näringslivet.[71]

Flera myndigheter är centrala för arbetet med försörjningsberedskap inom läkemedelsområdet. FBC ersätter läkemedelsfabriker- och importörer för de kostnader som lagringsskyldigheten medför[72] och kompletterar egna lager av vissa sällsynta läkemedel och skyddsmaterial, t.ex. antivirala läkemedel. En uppgift för FBC är att undersöka hälsovårdssystemets logistik- och infrastrukturberoende. Hälsovårdens kontinuitet är beroende av många stödfunktioner som diagnostik, röntgen, textil-, material- och läkemedelsförsörjning samt energi-, vatten- och dataförsörjning. FBC främjar privat-offentlig samverkan och frivillig beredskapsplanering bland privata företag som säljer material eller tjänster till hälsovårdssektorn.[73] Säkerhets- och utvecklingscentret för läkemedelsområdet (FIMEA) ansvarar för tillsyn och övervakning av verkställandet av lagringsskyldigheterna.[74] Strålsäkerhetscentralen ansvarar för beredskap mot radiologiska och nukleära hot, Arbetshälsoinstitutet ansvarar för kemiska hot och Institutet för hälsa och välfärd ansvarar för biologiska hot. Centret för militär medicin är sakkunnigt inom krishanteringsrelaterad hälsovård.[75]

De finska kommunerna ansvarar för att tillhandahålla hälsovård för sina invånare, kommunvis eller i form av kommunalförbund. Det finns 16 sjukvårdsdistrikt med centralsjukhus och utöver det fem universitetssjukhusdistrikt: Helsingfors, Åbo, Tammerfors, Uleåborg och Kuopio. Ministeriet ger instruktioner för att kommunerna ska upprätthålla obligatoriska beredskapsplaner.[76]

Finska sjukvårdsdistrikt använder FBC:s HUOVI-portal i sin beredskapsplanering. De strävar efter en förmåga att kunna mäta nivåerna av kontinuitetshanteringeen. En annan strävan är en enhetlig grundnivå av planering och materiell beredskap i hela landet. Social- och hälsovårdsministeriet kommer revidera planering och råd i en nära framtid.[77]

1.3.1 Säkerhetsupplagring av läkemedel

Under det senaste decenniet har läkemedel i allmänhet blivit billigare i Finland, delvis p.g.a. ändrade patentregler. Statens inköpskostnader har minskat men marknaden har blivit hårdare för läkemedelsföretagen.

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[71] Fjäder, Christian. E-post 2015-09-03.
[72] Lag (979/2008) om obligatorisk lagring av läkemedel 12-13 §§.
[73] Fjäder, Christian. E-post 2015-09-03.
[74] Lag (979/2008) om obligatorisk lagring av läkemedel 17 §.
[75] Fjäder, Christian. E-post 2015-09-03.
[76] Fjäder, Christian. E-post 2015-09-03.
[77] Fjäder, Christian. E-post 2015-09-03.

Investeringarna och tillverkningen i Finland minskar. Även om många nya företag startas i branschen, köps de ofta upp och flyttas utomlands.[78] Finland importerar läkemedel för runt 1 800 000 000 euro, ca dubbelt så mycket som exporten runt 885 000 000 euro.[79] 87 procent av exporten kommer från EU och Schweiz.[80] Exporten är mer spridd. 38 procent går till EU och Schweiz, drygt en tredjedel till Ryssland och ytterligare en tredjedel till övriga länder.81 Vården i Finland ses som en av de bästa och mest kostnadseffektiva i Europa.[82]

Tillgången till läkemedel och sjukvårdsutrustning är en viktig del i landets säkerhetsstrategi. Säkerhetslager av läkemedel, vacciner och utrustning samt avtal med andra länder, bl.a. de nordiska, är medel för att uppnå detta. Vaccinlager ska finnas inför vissa epidemier. Landets regioner ska utveckla gemensamma upphandlingsförfaranden när läkemedel och sjukvårdsutrustning införskaffas. FBC samt nationella och internationella myndigheter samarbetar för att uppnå en enhetlig grundnivå av materiell beredskap i hela landet. [83] Viktiga dataresurser ska finnas på finska servrar. Privat-offentlig samverkan ska trygga tillgången på livsviktiga läkemedel.[84]

Under undantagsförhållanden kan läkemedelsfabriker, apotek eller andra tillhandahållare av hälsovårdsförnödenheter och -tjänster behöva anpassa sin verksamhet för att säkra hälsovården. Detta kan bl.a. innebära att ändra och/eller flytta verksamheten till annan ort.[85] Även en pandemi kan vara anledning till att tillämpa Beredskapslagen (1552/2011), som ger myndigheterna ransoneringsmöjligheter gällande social trygghet och tryggande av social- och hälsovården.[86] Enligt Beredskapslagen (1552/2011) kan ministeriet exempelvis ålägga en verksamhetsenhet för social- och hälsovården att utvidga eller lägga om sin verksamhet, helt eller delvis flytta verksamheten utanför sitt distrikt. Personer i behov av vård kan placeras i sin verksamhetsenhet oberoende av vad som tidigare har bestämts, föreskrivits eller avtalats. En verksamhetsenhet eller en del av den kan ställas till statliga myndigheters förfogande. Myndigheten kan kräva att verksamheter inom hälso- och sjukvården utvidgar eller ändrar sin verksamhet och helt eller delvis flyttar verksamheten till annan ort.[87]

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[78] Yle, 2015.
[79] Pharma Industry Finland, 2015, Pharmaceutical exports and imports.
[80] Pharma Industry Finland, 2015, Import by country.
[81] Pharma Industry Finland, 2015, Export by country.
[82] Health Consumer Powerhouse, 2015, s.7.
[83] Försvarsministeriet, 2010, s. 50.
[84] Statsrådets beslut 857/2013, s. 8.
[85] Beredskapslag (1552/2011) 87§.
[86] Fjäder, Christian. E-post 2015-09-03; Beredskapslag (1552/2011) kap. 8, kap. 11.
[87] Fjäder, Christian. E-post 2015-09-03.

Sjukvårdens olika aktörer är skyldiga att lagra läkemedel enligt Lagen (979/2008) om obligatorisk lagring av läkemedel. Detta gäller även läkemedelstillverkare och importörer av läkemedel. Syftet är att säkra åtkomsten när den normala tillgången på läkemedel är begränsad. Ett stort antal viktiga läkemedel ska lagras enligt lagen, även djurläkemedel för livsmedelsproducerande djur. De flesta aktörer ska lagra läkemedel motsvarande tre till tio månaders användning, tillverkning eller konsumtion. Sjukvårdens enheter ska hålla ett lager med de läkemedelspreparat som används vid verksamhetsenheten som motsvarar konsumtionen mellan tre och tio månader, dock inte vacciner som omfattas av det nationella vaccinationsprogrammet. Olika sorters standard- och näringslösningar lagras motsvarande konsumtionen under två veckor.[88] Läkemedelsfabriker ska, beroende på läkemedel, hålla ett lager för att kunna tillverka en mängd läkemedel motsvarande konsumtionen under tre till tio månader.[89] Importörer av läkemedel ska hålla ett lager motsvarande mellan tre och tio månaders konsumtion, beroende på läkemedel.[90] Även privata tjänsteproducenter inom hälso- och sjukvården kan ha vissa lagringsskyldigheter, i den mån de säljer tjänster till kommunerna.[91] Institutet för hälsa och välfärd ska lagra sex månaders genomsnittlig konsumtion av vaccin. Detta gäller vaccin som omfattas av det nationella vaccinationsprogrammet, inte influensavacciner.[92] Tillgång till hälsovårdens förbrukningsmaterial bygger på sjukhusens egna och FBC-ägda, decentraliserade beredskapslager. Medicinisk apparatur ansvarar sjukvårdsenheterna själva för, i viss mån genom avtal med privata företag.[93]

De läkemedelssubstanser som ska lagras specificeras i förordningen om obligatorisk lagring av läkemedel. Förordningen ger också mer detaljerade instruktioner om skyldigheter till obligatorisk lagring.[94] Lagen om obligatorisk lagring av läkemedel kommer framöver att revideras på grund av förändrade hotbilder och behov.[95] År 2012 ansåg en utredning att omfattningen av landets säkerhetsupplagringar, bl.a. läkemedelslager, bör prövas på nytt.[96]

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[88] Lag (979/2008) om obligatorisk lagring av läkemedel 7§.
[89] Lag (979/2008) om obligatorisk lagring av läkemedel 5§.
[90] Lag (979/2008) om obligatorisk lagring av läkemedel 6§.
[91] Lag (979/2008) om obligatorisk lagring av läkemedel 7§; Fjäder, Christian. E-post 2015-09-03.
[92] Lag (979/2008) om obligatorisk lagring av läkemedel 8§.
[93] Fjäder, Christian. E-post 2015-09-03.
[94] Statsrådets förordning (1114/2008) om obligatorisk lagring av läkemedel.
[95] Fjäder, Christian. E-post 2015-09-03.
[96] Arbets- och näringsministeriet, 2012.

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2. Country Report – Norway

Tone Bergan

Atomkameratene AS

2.1 Overview

Until recently, the secure of supply chains has up not been high on the security agenda in Norway.

The Norwegian Directorate for Civil Protection (DSB) publishes annually a "National Risk Picture" which is a risk assessment of possible national disasters that can affect national preparedness and disaster management (DSB 2013, DSB 2014). Twenty different scenarios describe short to medium term emergencies[97], and apart from energy supply, neither food, drinking water nor pharmaceutical products are considered critical supplies in these scenarios. The National Risk Analysis started as an initiative from the DSB and Ministry of Justice and Public Security, and is slowly becoming a more important part of the planning assumptions for emergency preparedness in all sectors of the Norwegian society

There are two driving factors that have put supply chain security higher up on the agenda: 1. the political situation in East Ukraine and 2. long-term developments in climate, food production and a rapidly increasing global population. Both the civilian sector and the defence sector are now analysing how to improve supply chain security and resilience. "Good military and civilian support is necessary for utilizing Norwegian and allied forces. The arrangements for such support are full of gaps and deficiencies, and the plans are not exercised. The challenges appear to be even larger if we include the needs regarding increased allied commitments in Norway, demand for quick responses, and an increased presence in the north" (Ekspertgruppen for Forsvaret av Norge, 2015)

Only 3% of Norwegian mainland is arable land, and the agricultural products produced in Norway constitute around 50% of the total food intake. The rest is imported. If imported fodder is excluded, the production is down to 39%. The Norwegian government aims for the highest possible degree of self-sufficiency of food, but realises that imported food will remain an important part of the daily diet: "The food supply is a critical function in Norwegian society. Supply preparedness in the food sector is based on both national production and imports, which should be maintained even in emergencies. A complete

[97] The scenarios could happen within the coming year, the horizon being 1-5 years.

disruption of supply lines for a longer period of time is not considered to be realistic by the current planning assumptions."[98]

Fisheries and aquaculture represent a large potential source of food, but much of this normally is exported. Long-term food chain preparedness plans include a restructuring of production and distribution, and redirecting fish for consumption within Norway

An invasion of Norwegian territory is perceived more likely now than in the previous 20 years. Based on the "total defence concept", the Norwegian armed forces is looking at renewing the civil-military support legislation and mechanisms. But, former defence chief, Sverre Diesen, believes there is no risk of a shortage of vital resources in Norway even if the security situation were to deteriorate[99]. Even in a crisis situation, we have allies (referring to NATO) in the west. Norway would not be completely cut off from other countries.

When analysing supply chain security, there are two challenges:

Emergency response in the event of accidents, disasters and emergencies

Preparedness for prolonged supply failures

The main focus in Norway has been on preparedness for prolonged supply failure. Except for water, the general assumption is that Norway should maintain a supply storage for 3 weeks of normal consumption. In addition, individual households are also considered to be an additional asset.

2.1.1 Legal basis for public-private partnership

The law on business contingency (Business Preparedness Act) entered into force on 1 January 2012. This Business Preparedness Act forms the legal basis for close cooperation with the food industries in crisis preparedness, and is an example of public-private partnership. The Act requires the private sector to help resolve any incurred serious supply problems. The Ministry of Industry and Fisheries (NFD) has been delegated government authority to issue provisions in those areas where the Ministry has responsibility for preparedness.

A special council for food chain security are consultants for NFD on matters concerning the security of access to food in emergencies. The Council consists of the main grocery store chains in Norway.

In order to have access to additional emergency provisions in the event of very severe supply failure, the NFD has established stockpiles. Stockpiles are located

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[98] From discussions in the Parliament (Stortinget) 2014

[99] Talk given at the FFI forum on September 18, 2014. Sverre Diesen now works as an analyst at the Norwegian Defence Research Establishments (FFI).

in various places in the country and consist of dried goods, freeze-dried food, and canned food. Some of the stored goods are used in connection with humanitarian aid operations outside Norway

2.1.2 Emergency preparedness in fisheries and aquaculture

The objective of contingency planning is to lay the framework conditions as favourable as possible for those industries that may also be affected by a crisis situation, including measures such as a reorganization of businesses with an emphasis on coastal and sea fishing as well as aquaculture. The main focus is on adapting to prolonged supply failure situations.

Norway scores well on food security[100] (ranking 9th out of 109 countries) with Sweden as 10th (The Economist 2015 – The Global Food Security Index). The Economist uses the Global Food Security Index to assess core issues such as affordability, availability, and quality of food . This index is a dynamic quantitative and qualitative benchmarking model based on 28 unique indicators that measure the drivers of food security in both developing and developed countries.

2.1.3 Pharmaceutical supply chain

The Norwegian Directorate of Health published a report in 2012 analysing national pharmaceutical preparedness and the possible need for stockpiles (Helsedirektoratet 2012). Two major improvements were suggested: increased responsibility for industry (following the public-private partnership lines) and increased responsibility for the regional hospitals. The regional hospitals are responsible for their own consumption of pharmaceuticals and medical equipment , and the Norwegian Directorate of Health administers the stockpiles on a national level, through agreements with the industry.

2.1.4 Drinking water

Providing drinking water is a municipal responsibility in Norway. Drinking water is considered easily available, with plenty of available water sources. The Norwegian Food Safety Authority is monitoring emergency plans at the water works and in the municipalities.

2.1.5 Supply chain security in general

Norway relies on public-private partnership for addressing these issues, but the issue of national stockpiles is still regarded a state responsibility. One reason is that the legislation, the Business Preparedness Act, is still fairly new and has not been fully implemented. Also, the politicians are not fully ready to rely on the private companies and their emergency preparedness. An example of this is the current discussion on the need for national food storage (Pettersen 2014,

[100] The concept “food security” considers both availability and quality.

Pettersen 2015). Public-private partnership requires thorough and transparent risk and vulnerability analyses as a basis for decision making.

The Business Preparedness Act lays down the provisions for government requests from the private sector during demand shocks, supply failure, or logistical shortcomings. In order to ensure that the needs of the population, the military defense, allied military forces in Norway, and international obligations related to goods and services are covered, the King may issue further provisions on:

a) priorities, reallocation, storage and cession of goods, provision of services, as well as preparation and participation hereto, including provisions relating to import, export, distribution of goods and sales of goods and services, including revenue-regulatory measures.

b) the obligation for businesses to supply or manufacture goods or provide services for specific purposes or specific recipients.

c) the obligation for business to refrain from temporary disposal on certain properties

d) the obligation for traders to provide and document information, including information on stocks, rollover, production, trade, transportation and storage, logistics, accounting, etc.

e) the obligation for business to cooperate with public authorities to find effective solutions for dealing with the lack of access to goods and services.

f) an obligation for businesses to implement or contribute to analyzes and studies related to the security of supply.

g) obligation for businesses, trade organizations and associations to participate in the special bodies established or created to help ensure the supply of goods and services during emergencies.

h) obligation for businesses to plan or participate in planning and conducting exercises and other training in crisis management.

i) the obligation for businesses to give notice of circumstances which may provide the grounds for special measures.

j) obligation for businesses to plan, prepare and execute, or contribute to the planning, preparation and implementation of special measures.

An example of a general agreement with a food distributor is provided at the end of this report.

2.1.6 Good practices

Norway has a more systematic use of risk and vulnerability analysis and a systematic distribution of responsibility. The National Risk Analysis presents

and discusses 20 catastrophes that could affect Norway; scenarios that the Norwegian society should be prepared for. Guidance is given to regional and local authorities (DSB 2012) on how to perform analysis within their own area of responsibility, and how this should be implemented in local planning and preparedness.

Societal security and emergency preparedness are often and probably will always be a political issue, especially when it comes to allocating money and other resources. The current government is promoting public-private partnership in these issues, dissolving previous national stockpiles. The Business Preparedness Act has been a renewed legal instrument in this work.

2.1.7 How is Norway dealing with securing critical supply chains?

There is an ongoing work in Norway, commissioned by the Ministry of Justice and Public Security, on defining critical infrastructure and critical services[101] in the Norwegian society. Identifying critical supply chains is part of this work, which is being done by DSB.

The regulations related to the security in supply chains of food, drinking water and pharmaceuticals consist of:

- LOV-2003-12-109-124 Lov om matproduksjon og mattrygghet mv. - Matloven (Act on food production and food safety).
- LOV-2011-12-16-65 Lov om næringsberedskap Næringsberedskapsloven (Act on commercial readiness). Nærings- og fiskeridepartementet
- LOV-2000-06-23-56 Lov om helsemessig og sosial beredskap Helseberedskapsloven (Act on Health and Social Preparedness). Helse- og omsorgsdepartementet
- FOR-2001-07-23-881. Forskrift om krav til beredskapsplanlegging og beredskapsarbeid mv. etter lov om helsemessig og sosial beredskap. (Regulation for emergency planning and preparedness work) Helse- og omsorgsdepartementet
- FOR-2001-12-04-1372. Forskrift om vannforsyning og drikkevann Drikkevannsforskriften (Regulation on water supply and drinking water) Helse- og omsorgsdepartementet

The Ministry of Industry and Fisheries (NFD) has the main responsibility for emergency food supplies and consumer goods in Norway. They also coordinate the work of supply response, including monitoring of the Act on commercial

[101] Work is performed by the Norwegian Directorate for Civil Protection

readiness. This ministry has since the late 1990s had a working relationship with food distributors on issues within civil protection and emergency planning. The Council for Food Security (Rådet for matvareberedskap)[102] is part of NFD's emergency organisation. In addition, the members participate in exercises and have regular meetings where relevant topics related to food security are discussed. The agencies participating in the Council have also prepared restocking plans and business continuity plans for pandemic scenarios.

There are no predetermined goals or objectives set for supply chains, other than that each provider should ensure self-sufficiency. For food supplies, the general aim is that a normal diet should be sustained, and reference is made to the general recommendations on 2900 kcal/day/person, (Nærings- og handelsdepartementet, 1995).

Based on a risk and vulnerability analysis performed in 2002, (Nærings- og handelsdepartementet, Landbruksdepartementet 2003) there are storehouses with dry food, freeze dried food and canned food for the population living in Northern Norway (north of Lofoten). The supplies are for 8 days. The Ministry of Industry and Fisheries will perform a new risk and vulnerability analysis, starting this year.

During the discussions around the National Budget for 2015, the decommissioning of an emergency stockpile of grain became an issue. This is discussed in more detail in "Risiko og sårbarhetsanalyse for norsk matkornforsyning" (Pettersen 2015). The analysis shows that as of today, there is a very low probability for events that might require a national stockpile of grain. However, it is recommended that the security of the food chain is regularly reviewed and an integrated part of emergency preparedness and planning.

2.1.8 Strategic foresight

There are no programmes on strategic foresight as such. However, each sector and each provider performs their risk and vulnerability analyses with some consideration for future risks and developments. The perceived trends are being assessed in the World Economic Forum: Global Risks 2015 (WEF 2015), Ministry of Defence, UK, Strategic Tends Programme – Global Strategic Trends, up to 2045 (MoD, 2014), and OECD, Emerging risks into the 21st century (OECD 2003).

The Norwegian National Security Authority (NSM) predicts that cyber security will become even more important, and that control systems for infrastructure

[102] The Council for Food Security is working with food supply chain security, not food security as such, which is the responsibility of Mattilsynet.

and industry are vulnerable. These factors influence supply chain security to a great degree as well (NSM 2015, FFI 2014, DSB 2015).

2.2 Food supplies

2.2.1 Overview

The government (Ministry of Food and Agriculture) stated in 2014 that: "Food supply is a critical function in Norwegian society. Supply preparedness in the food sector is based on both national production and imports should largely be maintained even in emergencies. A complete shut off of supply lines for some time is not considered to be realistic by the current planning assumptions."[103]

Norway is a country with very limited farmland per capita (3% of the total area is arable land) and has in modern times been dependent on many agricultural commodity imports particularly grains, sugar, fruit and vegetables (Rålm 2014).

Norwegian authorities are using the UN Food and Agriculture Organization's (FAO) definition of "food security" from 1996: "Food security exists when all people, at all times, have physical, nutritious food to meet dietary need and preferences for an active and healthy life." Norwegian food security is focused on how to prepare for possible emergencies where food distribution is or may be seriously threatened (Grue, 2012, Prestegard 2015). Possible emergencies can arise from trade policy measures in the EU region or in Norway, which could make imports of agricultural commodities far more difficult or at worst come to a full stop.

It is also a real risk that long-term food supply failures globally can become a reality because of rapid population growth in the world, resource scarcity, and climate change.

Moreover, major environmental and pollution disasters in terms of radioactive fallout, toxic emissions, serious animal and plant disease outbreaks, earthquakes, volcanic eruptions, and the such reduce food production in Norway, both on land and at sea, as well as possibilities for imports. Malicious acts (such as intentional poisoning or contamination of food) have up till now been considered to have limited consequences, and would have little or no effect on the security of food supply chain as such.

Several strategies are employed to ensure adequate food security in Norway in the event of a serious crisis. One long-term strategy is to promote a well-functioning international trading system[104] that can ensure that it will be

[103] From discussions in the parliament 2014

[104] Through the World Trade Organization (WTO) and the European Economical Area (EEA)

possible with at least some (limited) imports also during a crisis. This strategy is supplemented with bilateral trade agreements.

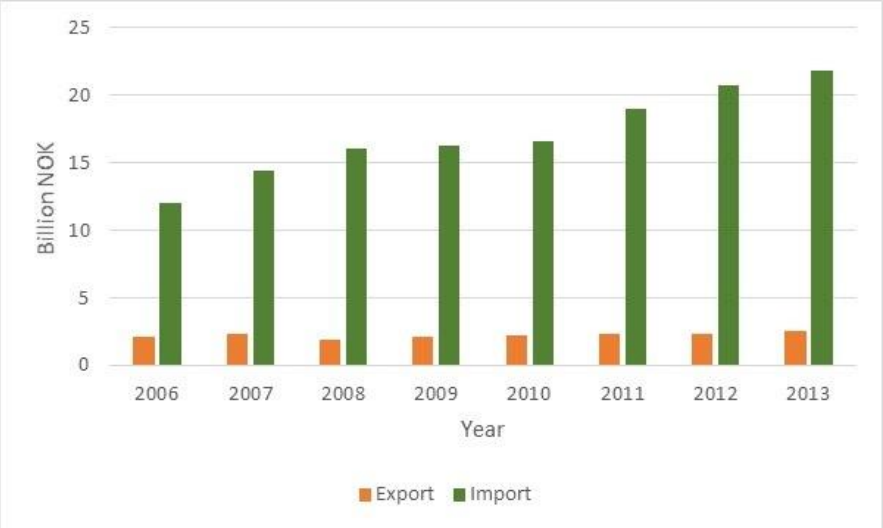

Figure 1. Norwegian import and export of agricultural produce – development from 2006. (Source: Statistics Norway, ssb.no)

Storage of agricultural product and input means (such grains, seeds, fertilizers) may help limited the impact of short-term supply crises and provide time for restructuring long-term changes. In more protracted emergency situations, there will have to be a reorganization of domestic production and changes in diet. The general diet could be shifted towards more grains and vegetables and less dairy products and meat. Maintaining a current agricultural production across the country, to preserve agricultural areas, maintain livestock populations, machinery, buildings and knowledge of agriculture for future food production will be essential in order to meet more protracted crises. This is, however, not considered the main strategy.

It has been identified that increased food production in terms of unchanged or increased self-sufficiency in normal times does not necessarily give good food security in times of crisis. Food production in Norway is mainly consisting of a limited number of basic food stuffs, and a normal diet consists of a considerable amount of fruits, vegetables, sugar and other products not produced in Norway (Meld. St. 9, 2011, NOU 2015:1)

The main focus in Norway has been on preparing for prolonged supply failures. With the exception of water, the general assumption is that Norway maintains a storage for 3 weeks of normal consumption. During emergencies, individual households are also considered to be an additional asset.

There used to be general recommendations on what should be stored at home, and the recommendations would be a detailed list of e.g. number of cans with condensed milk, other canned food, flour etc. The last revision was published in early 1990, and no further recommendations have been published.

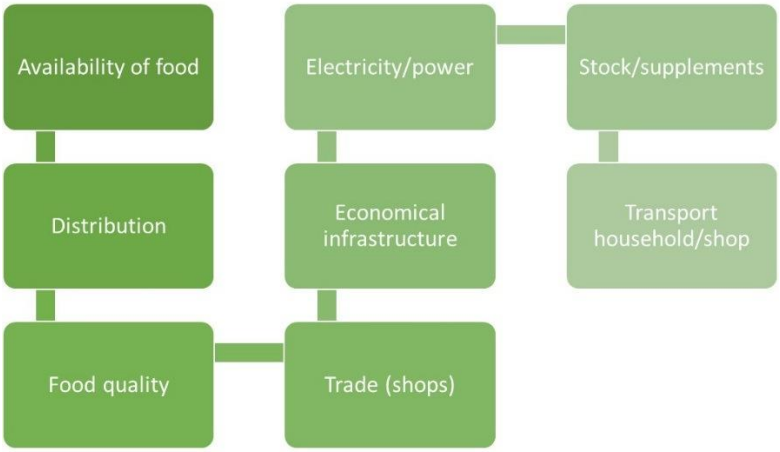

Figure 2. An example of food supply chain elements.

All supply chains involve interdependencies, with critical infrastructure and other critical societal functions.

- Availability of food includes production in Norway, import, necessary means of production (such as fodder, fertilizers, machinery, fuel, available land) and initial stock.
- Distribution is dependent on road, air or sea transport, distribution companies, and network etc.
- Food quality involves laboratory controls, temperature control, hygiene, and proper slaughtering of animals etc.
- Trade is dependent on local grocery stores (systems for receiving and trading food).
- Economical infrastructure is needed for the grocery stores to trade (and for Norway as a country to import food).
- Electricity/power is needed for stock supplies, transport, food quality, and trade.
- Stock supplements – once the initial goods are sold, the system for resupply must be functional.

- Transport household/shop involves local transportation – the ability for the end consumer to bring the food to the household (From the framework for analysing National Risk Analysis and Critical Societal functions – unpublished, DSB).

Up until today, much focus has been on food production and food storage. Less attention has been on the distribution chain and securing food reaching the end user. However, this responsibility is put on the commercial food distributors. Cooperation between the Ministry of Industry and Fisheries and the Council for Food Security works well and this has been considered a good model for further development of food chain security. The distribution of responsibility is exemplified in the Annex, as a general agreement between the Ministry and a distributor.

2.3 Drinking water supplies

There are more than 1700 waterworks in Norway, ranging from small, private cooperatives to large, public waterworks supplying one or more municipalities with water.

Drinking water, in general, is regarded easily available, with several backup sources.

According to §8 of the Regulation for emergency planning and preparedness work etc. (FOR-2001-07-23-881) based on the Act on health and social preparedness (LOV-2000-06-23-56), companies must ensure adequate security for the supply of all essential materials, equipment and pharmaceuticals. They do not need to report this information, but may be subject to audits from local authorities or regional authorities, depending on their role in the supply chain.

2.3.1 Emergency preparedness

The waterworks are responsible for providing safe drinking water. They must have their own emergency plan for managing incidents. There are guidelines for the waterworks' contingency planning. The waterworks/municipality is responsible for ensuring emergency water supplies. They must ensure there is a proper source, and oversee this as well as water treatment/disinfection. Reference is made to the Swedish guide on Nødvann.[105]

Preparedness in the water supply chain is particularly important since the events can quickly become large and many people and businesses might be affected. Under the Contingency Plan Regulations § 3, (FOR-2001-07-23-881), waterworks shall conduct a risk and vulnerability analysis. The analysis shall be

[105] www.slv.se

the basis for all necessary measures that must be done to ensure a healthy and safe drinking water, including security and preparedness.

The waterworks have different organisations and complexity, as well as differences in available resources for managing crises. Mattilsynet (the Norwegian Food Safety Authority) shall supervise the operation and management, and must intervene if necessary. In acute situations there may be a need for support, and Mattilsynet should be prepared to assist with assessment of the situation.

Special events related to storms with flooding or power failures require extraordinary surveillance, and the waterworks must have plans for these kinds of problems.

2.3.2 Disappearance of water supply

A short term (a few hours) disruption would normally be handled by the waterworks and respective business owner. Vulnerable businesses are according to the environmental legislation often required to have necessary contingency plans. A somewhat longer disruption will require resources and measures beyond what the waterworks can be expected to handle. At that point, the municipal emergency preparedness function will be expected to assist with their emergency organisation, in cooperation with other municipalities or via the county governors or by organising alternative ways to distribute water.

2.3.3 Emergency water supplies

Some municipalities in Norway have experienced contaminated drinking water, due to microorganisms or flooding. In many cases, the water is still drinkable, after boiling. At the same time, the purchase of bottled water has increased. Clean water has also been transported in containers and fire trucks from neighbouring water works.

2.3.4 Operators who may have a role in a water incident

Norwegian Water is a membership organisation for water works, where most major waterworks are members. Membership is not mandatory. Norwegian Water acts as an interest group, and has put several preparedness issues on the agenda. They have undertaken a coordination responsibility for their members. In a major event, Norwegian Water can act as a liaison. Norwegian Water is now considering giving support for waterworks in case of emergency events.

Owners may be private, municipal or inter-municipal units. Many of the large waterworks are closely integrated with the local authorities, or have a large organisation in support in the event of incidents.

If a private water supply company fails to fulfill its obligations in an emergency situation, the municipality in such cases, are responsible for public health (LOV-2000-06-23-56), (LOV-2010-06-25-45). This includes, among others, tracing and control of communicable diseases in the population. The

municipality will also often take responsibility for alternative water supplies when necessary, for example by providing water wagons. In general, the municipality is responsible for the population living in the area, and must perform at risk- and vulnerability analysis to identify possible risks and relevant mitigating actions (DSB, 2012).

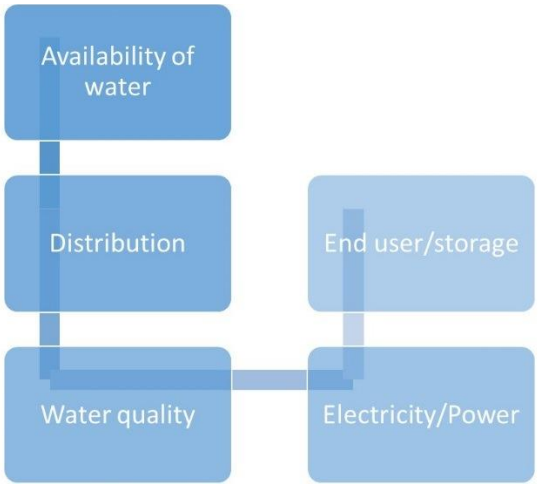

Figure 3. The drinking water supply chain elements. The water supply chain is somewhat simpler, as distribution is on a separate system, however very dependent on electricity/power, and some systems also rely on ekom-infrastructure. (DSB, framework for analysing Critical societal functions - unpublished)

If the incident involves several municipalities, several waterworks or a large regional water supply system, it may be necessary that the County Governor's (Fylkesmannen) office coordinates the emergency situation and the actions taken.

The fire service is the primary task force for chemical incidents and will in accident situations prevent or limit acute pollution of the water source. Inter-municipal Committees for Acute Pollution (IUA) will assist at major events.

The Norwegian Coastal Administration (Kystverket) is the acute pollution authority both on land and in coastal areas, and will assist at major events with contamination of water. The Civil Defence can be a key partner by contamination of the water source, and has great resources and manpower associated with their organization (DSB 2012). The Civil Defence has in previous events provided manpower and vehicles for distributing water to hospitals and other critical institutions.

The Norwegian Directorate for Civil Protection (DSB) has an advisory role in relation to issues that might arise in the handling of accidents / sabotage involving chemicals and major accidents.

The Norwegian Institute of Public Health's (FHI) role in the investigation of infectious diseases is the same for water and food. FHI has a role in the area of expert support. FHI also has a role in terms of assistance in chemical events, and evaluation of health risks associated with various substances (including radioactivity) in water treatment.

2.4 Pharmaceutical supplies

The pharmaceutical industry is an international industry, with their main distribution points in only a few countries in Europe. There are no storehouses in Norway, which could lead to Norway having a securer supply in a critical situation.

There has been a tendency for the multinational pharmaceutical industry to move out of Norway. Today, there is a very small production of pharmaceuticals in Norway. A total of 9 companies have production facilities in Norway, and this includes sterile medical equipment. Supplies are distributed directly to the pharmacy chains in Norway, and the hospital pharmacies are part of these chains.[106]

Increasingly tight inventory management with correspondingly less stocking of all drug supplies is a challenge from an emergency preparedness standpoint, and increases vulnerability in the supply chain. Up until 2002, Norsk medisinaldepot, NMD, was a state organization, responsible for import, storage and distribution of pharmaceutical supplies and medical equipment in Norway. NMD was the only company licensed to do this in Norway. Today, they are privatized, and one of several actors on the market.

The possible need for pharmaceuticals in Norway is based on different risk and vulnerability analyses. The National Risk Analysis (DSB) is part of the planning assumptions (pandemic flu scenario and nuclear accident scenario more specifically). The national pandemic flu emergency plan was revised after evaluation of the 2009/2010 H1N1 flu.

The national pharmaceutical supply plan (National drug readiness - strategy and plan) was published with recommendations for further plans and responsibilities (Helsedirektoratet 2012): "A robust supply of medicines, equipment and materials" is an overarching long-term goal given as a task in annual letters of allocation to the Directorate of Health under the Ministry of Health and Care. As part of this mission, the Directorate of Health administers the agreement with drug wholesalers on emergency stockpiles of drugs. The mission is to ensure that emergency stocks have an emergency profile that is adapted to current challenges.

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[106] http://www.farmatid.no/artikler/meninger/legemiddelberedskap-moderne-tider

National stockpiles are established by two different models;

- Stocks of drugs for an agreed sum against the Directorate of Health pay stock binding and handling fee. These medicines included in the wholesaler's trade rollover. The revolving warehouse stock contains approximately 700 different drugs and are located as part of the wholesaler's warehouse.
- Warehousing and storage fees for emergency medicines purchased by the Health Directorate. These are not included in the wholesaler's trade rollover.

Examples of content:

- Antibiotics (tablets and syrups)
- Important / Critical drugs (major consequences if deficient) - Insulin, heart medicine, cancer medicine, epilepsy drugs, and mild painkillers
- Antidote
- Certain medicines with a history of unstable supply

If situations arise where it is necessary to use larger quantities, the Directorate of Health must assess the current situation.

Preventative drugs purchased and owned by the Directorate of Health constitute:

- Potassium iodide, ca. 200,000 packs of 10 tablets
- Tamiflu 75 mg, ca. 1.2 mill. gaskets
- Tamiflu 45 mg, ca. 84,000 packs
- Relenza, ca. 213 000 seals
- Rimantadine, ca. 300,000 packs of 80 tablets

Use of these drugs is decided by the Directorate of Health. Durability is a challenge when it comes to national stockpiles that does not normally revolve with ordinary sales.

Also the Institute for Public Health (FHI) fulfills its public safety responsibilities by having a revolving stockpile equivalent to 6 months of normal consumption:

- All vaccines in the vaccination program
- Special critical vaccines
- Specific immunoglobulins

The Institute also has a revolving stockpile equivalent to 4 months normal consumption of other vaccines with steady consumption.

The municipalities also have a responsibility. According to the Act on Municipal Health Services (LOV-2000-06-23-56), the municipality has overall responsibility for health care. The municipality shall ensure that all persons residing in the municipality are offered the necessary health services. This means that municipalities through their responsibility to provide health care to the population also have the responsibility for emergency protection of these services, including drugs used to provide essential health services.

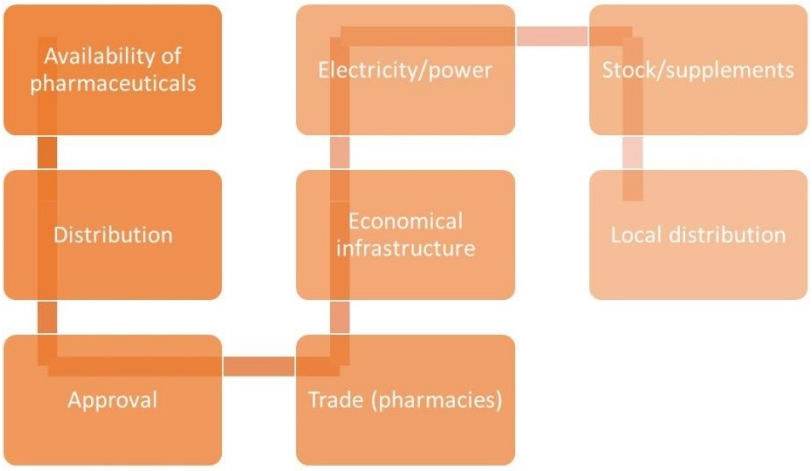

Figure 4. An example of the pharmaceutical supply chain elements (DSB, framework for analysing Critical societal functions - unpublished)

As illustrated in figure 4, the pharmaceutical supply chain elements are very similar to the food supply chain, where the biggest difference is the approval step. New vaccines or pharmaceuticals need to go through an approval stage, which can involve testing, declaration or legal matters

In this report, the Directorate of Health recommends that models for risk analysis and risk management of medicines are used when securing drug supply chains. The regional hospitals (RHF) should be given responsibility for this in terms of drugs used in hospitals. Medicines prescribed in primary care should be secured by establishing agreements with the wholesalers, on keeping the stockpile of scheduled drugs in agreed quantities. This work is under way.

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Bilaga 3.1: U. off. Offentleglova § 21

Nærings- og fiskeridepartementet (heretter NFD) og X har denne dag inngått følgende

SAMARBEIDSAVTALE OM SAMFUNNSSIKKERHET, BEREDSKAP OG KRISEHÅNDTERING

1. Bakgrunn

Når det på grunn av risiko for etterspørselssjokk, tilbudssvikt eller logistikkbrist er nødvendig for å sørge for at befolkningens behov, det militære forsvarets behov, allierte militære styrkers behov i Norge eller internasjonale forpliktelser knyttet til varer og tjenester dekkes, kan Kongen etter lov 16. desember 2011 nr. 7 om næringsberedskap (næringsberedskapsloven) § 5 gi nærmere bestemmelser om en rekke tiltak for å avhjelpe situasjonen. Etter lovens kapittel 3 kan også Kongen iverksette slike særskilte tiltak uten at bestemmelser er gitt på forhånd. Tiltak skal iverksettes i samarbeid med

næringene. Vedtak om særskilte tiltak kan ikke fattes dersom formålet kan oppnås i tide på annen måte.

Ansvaret for å vurdere behovet for og forberede slike tiltak innenfor matvaredistribusjon ligger til NFD. På denne bakgrunn og i nært samarbeid med andre myndigheter med beredskapsansvar har NFD besluttet å inngå samarbeidsavtaler med sentrale aktører innenfor matvaredistribusjon.

Denne avtalen skal erstatte tidligere avtaler om samarbeid for krisesituasjoner mellom NFD og en rekke sentrale aktører innen matvaredistribusjon og representerer først og fremst en tilpasning til næringsberedskapsloven.

2. Omfanget av særskilte forpliktelser for matvareberedskap

Avtalene omfatter alle de tiltakstypene som er listet i lovens § 6:

a) prioritering, omfordeling, lagring og avståelse av varer, utførelse av tjenester, samt forberedelser og medvirkning hertil, herunder bestemmelser om innførsel, utførsel, distribusjon av varer og omsetning av varer og tjenester, herunder omsetningsregulerende tiltak

b) plikt for næringsdrivende til å levere eller framstille varer eller yte tjenester til bestemte formål eller bestemte mottakere

c) plikt for næringsdrivende til å avstå løsøre og fast eiendom for midlertidig disponering

d) plikt for næringsdrivende til å gi, og så langt som mulig dokumentere informasjon, herunder informasjon om varebeholdninger, rullering, produksjon, omsetning, transport og lagring, logistikk, regnskap m.m.

e) plikt for næringsdrivende til å samarbeide med offentlige myndigheter om å finne effektive løsninger for å håndtere manglende tilgang til varer og tjenester

f) plikt for næringsdrivende til å gjennomføre eller bidra til gjennomføring av analysearbeid og utredninger knyttet til leveringssikkerhet

g) plikt for næringsdrivende, næringsorganisasjon eller -sammenslutning til å delta i særskilte organer som er opprettet eller opprettes for å bidra til å sikre tilgangen på varer og tjenester i kriser

h) plikt for næringsdrivende til å planlegge eller delta i planlegging og gjennomføring av øvelser og annen opplæring i krisehåndtering

i) plikt for næringsdrivende til å varsle om forhold som kan gi grunnlag for særskilte tiltak

j) plikt for næringsdrivende til å planlegge, forberede og gjennomføre, eller bidra til planlegging, forberedelse og gjennomføring av særskilte tiltak

I en krisesituasjon kan det være behov for å spre informasjon gjennom flere kanaler. Når NFD får utarbeidet informasjon til forretningsdrivende og/eller

befolkningen om fornuftig utnyttelse av tilgjengelige ressurser, risikofaktorer eller lignende i kriser vil X bruke sine ordinære informasjonskanaler til å spre informasjon når dette er hensiktsmessig.

3. Sentral kriseorganisasjon for matvaredistribusjon

Den sentrale kriseorganisasjon for matvaredistribusjon videreføres med Rådet for matvareberedskap som ledelse. Rådet skal være et rådgivende organ for NFD ved beredskapsplanlegging og et forum for informasjonsutveksling om saker av betydning for matvareforsyningen i landet eller deler av landet. Organet skal også fungere som NFDs krisehåndteringsorganisasjon innenfor sin sektor.

For å opprettholde en effektiv logistikkløsning ved kriser i fred, beredskap og i krig, er det nødvendig i størst mulig grad å opprettholde ordinære distribusjonsmønstre og å unngå konkurransevridning. Rådet for matvareberedskap bør om mulig konsulteres før særskilte tiltak for å bedre matvaretilgangen iverksettes.

X forplikter seg til å delta i ledelsen av den sentrale kriseorganisasjonen for matvareberedskapen gjennom Rådet for matvareberedskap. Deltagelsen må være på et nivå som er hensiktsmessig i forhold til de oppgavene som skal løses både innen rådgivning og krisehåndtering. X peker ut et medlem og en vararepresentant til Rådet for matvareberedskap. Alle som deltar enten som medlem av Rådet for matvareberedskap eller i konkrete utrednings- og planleggingsoppgaver innenfor rådets oppgaveportefølje må kunne sikkerhetsklareres for minst nivå HEMMELIG etter sikkerhetsloven.

Arbeidsoppgavene i Rådet for matvareberedskap vil blant annet omfatte høringsuttalelser om prinsippdokumenter knyttet til beredskapsforberedelser og - tiltak. Rådet skal også peke ut konkrete områder som bør underkastes nærmere utredning med utgangspunkt i de gjeldende planleggingsforutsetningene. Dette kan dreie seg om f.eks. scenarioer, generell krisehåndtering og - adferd, tilgang på konkrete vareslag, transporttjenester, datatjenester, telekommunikasjon eller elektrisk kraft og mulige løsninger. Rådet kan anbefale konkrete tiltak, og må i den grad det er nødvendig samarbeide med andre kriseorganisasjoner.

Leder- og nestlederfunksjonen i rådet går på omgang blant rådets medlemmer etter nærmere kriterier fastsatt av rådet selv.

4. Leveringsplikt

I tillegg til ordinære leveranser til detaljister som omsetter matvarer til forbrukere og ordinære leveranser til storhusholdninger, påtar X seg å sørge for nærmere spesifiserte leveranser til Forsvaret ved mobilisering. X påtar seg også så langt som mulig å bistå myndighetene ved leveranser til sivilbefolkningen ved masseforflytninger eller andre tilsvarende store endringer i

forbruksmønsteret som følge av ekstraordinære krisesituasjoner i fred, krig eller ved beredskap. Dersom X oppfatter forsyningssituasjonen som kritisk, plikter firmaet å ta saken opp med NFD som må vurdere om særskilte tiltak skal iverksettes eller anbefales iverksatt.

Xs forpliktelser til leveranser av matvarer gjelder i den utstrekning disse ikke umuliggjøres som følge av hindringer i import -, produksjons- eller transportledd utenfor partenes kontroll. Hvis behovet for leveranser av en eller flere varer i en krise- eller krigssituasjon er vesentlig større enn normalt, skal X gjøre det som er mulig for å oppfylle plikten til å levere. I en situasjon der tilbudssvikt, etterspørselssjokk eller logistikkbrist utgjør en risiko for befolkningen eller større deler av befolkningen skal X yte bistand for å minimalisere konsekvensene.

Hvis virkningen av en krise- eller krigssituasjon vanskeliggjør forpliktelser i henhold til denne avtalen, skal X snarest mulig informere NFD. NFD skal så langt som mulig bidra til å løse problemene eller til å finne alternative løsninger for å sikre leveranser.

Så lenge myndighetene ikke har innført særskilte reguleringsordninger, skal leveranser av varer og tjenester skje på ordinære kommersielle vilkår. Endringer i pris- og leveransevilkår kan ikke alene påberopes som grunn til å fravike lovpålagte forpliktelser.

Kvaliteten på leverte varer og tjenester skal være i overensstemmelse med det til enhver tid gjeldende regelverk.

5. NFDs og andre myndigheters forpliktelser

NFD har etter avtale med andre berørte departementer samordningsansvar innenfor matvareforsyningsberedskap. NFD har også fagansvar, og dermed et selvstendig beredskapsansvar, innenfor videreforedling og distribusjon av matvarer.

NFD er ansvarlig for å vurdere og om mulig iverksette nødvendige tiltak som gjør det mulig for X å gjennomføre de forpliktelser som er nedfelt i avtalen

Næringsdrivendes dokumenterte økonomiske meromkostninger eller tap ved forberedelser til og gjennomføring av særskilte tiltak kompenseres tilsvarende bestemmelsene i næringsberedskapsloven § 17.

Når departementet beslutter at det er nødvendig med utredninger eller med ekstraordinære tiltak som f eks lageroppbygging, dekkes utgifter til dette. Det forutsettes imidlertid at varene omsettes på normale kommersielle vilkår av de næringsdrivende.

NFD dekker utvalgsgodtgjørelse for møter i Rådet for matvareberedskap etter gjeldende satser i Staten. Reelle kostnader til deltakelse i øvelser skal kompenseres av den etaten eller det departementet som er ansvarlig for øvelsen når det stilles krav om dette fra de næringsdrivendes side.

NFD stiller sekretariat for Rådet for matvareberedskap. I den grad rådets medlemmer ønsker det kan bransjeorganisasjoner delta som observatører i ordinære møter i rådet og ved krisehåndtering med den oppgave å samordne næringens synspunkter, bidra til utredninger etc.

NFD er ansvarlig for nødvendige sikkerhetsklareringer og autorisasjoner. NFD samordner også fritakssøknader til Forsvaret og andre beredskapsorganisasjoner for personell i de berørte firmaene når det er nødvendig.

6. Opplysningsplikt

Næringsdrivende har plikt til å gi opplysninger til beredskapsformål. X gir NFD fullmakt til å innhente opplysninger som er nødvendige til beredskapsformål fra

a) ligningsmyndigheter og andre skattemyndigheter, toll- og avgiftsmyndigheter og andre myndigheter med ansvar for regulering og kontroll av import og eksport,

b) andre myndigheter med ansvar for regulering av ervervsvirksomhet,

c) Brønnøysundregistrene og andre registereiere,

d) andre myndigheter med informasjon av betydning for beredskapsplanlegging eller krisehåndtering etter denne loven.

Fullmakten gjelder uten hensyn til taushetsplikt, men opplysningene kan bare benyttes til beredskapsformål og NFD skal sikre at færrest mulig får tilgang til dem.

7. Taushetsplikt

Taushetspliktbestemmelsene i lov 10 februar 1967 om behandlingsmåten i forvaltningssaker (forvaltningsloven) kommer til anvendelse for X og dets ansatte. Dette innebærer bl.a. at X plikter å hindre at andre får adgang eller kjennskap til det han får vite om noens personlige forhold i forbindelse med eller som følge av denne avtalen. Det samme gjelder tekniske innretninger og fremgangsmåter og drifts- eller forretningsforhold som det vil være av konkurransemessig betydning å hemmeligholde av hensyn til den opplysningen angår. På samme måte har firmaet taushetsplikt om opplysninger som nevnt i lov 19 mai 2006 nr 16 om rett til innsyn i dokument i offentleg verksemd (offentleglova) §§5 og kapittel 3 og om opplysninger som er graderte etter lov 20 mars 1998 nr 10 om forebyggende sikkerhetstjeneste (sikkerhetsloven) kapittel 4.

8. Endringer av avtalen

Endringer av avtalen må avtales særskilt og skriftlig.

9. Overdragelser m m

X kan ikke overdra avtalen uten NFD's skriftlige samtykke. X kan ikke benytte underleverandører for oppfyllelse av sine plikter i henhold til denne avtalen uten etter skriftlig avtale med NFD.

10. Avtaleperiode - Oppsigelse

Denne avtalen trer i kraft ved undertegning og gjelder inntil videre. Avtalen kan skriftlig sies opp av partene med 12 måneders varsel dersom det inntreffer omstendigheter som medfører at avtalens forutsetninger er bortfalt.

Videre har partene rett til å si opp avtalen med umiddelbar virkning ved opphør av virksomhet, konkurs eller tilsvarende.

11. Lovvalg

Partenes rettigheter og plikter etter denne avtalen bestemmes i sin helhet av norsk rett.

12. Tvist

Dersom det oppstår tvist i forbindelse med avtalen, skal saken søkes løst ved forhandlinger. Fører forhandlinger ikke frem skal saken avgjøres av ordinære domstoler. Oslo er verneting dersom partene ikke enes om et annet sted.

13. Undertegning

Denne avtale er undertegnet i 2 - to - eksemplarer, hvorav hver part beholder 1 - ett – eksemplar.

3. Country Report – Denmark

Martin Kruse and Adam Svendsen

Instituttet for Fremtidsforskning (IFF)

Rasmus Blædel Larsen

Københavns Universitet

3.1 Overview

The Danish Emergency Management Agency states that: 'In general, Denmark is a safe society, with a well-functioning infrastructure and a high degree of security in energy supply (DEMA 2015, p.3). Generally, Danish Crisis Management strategies, priorities, 'best practices' (competencies), and areas of aspiration, even inspiration - including those relating more specifically to longer-term supply chain security (the main focus of this report) - are all geared towards maintaining a safe society over and above sustainably for a longer period of time.

Overall, objectives are focused on best utilizing Denmark's collective societal resources in order to return to 'normality' as quickly as possible, as well as limit incident and/or accident (crises') consequences and impacts as far as possible, wherever and whenever they occur. This response approach strongly overlaps with recovery and/or reconstruction interests, as well as currently developing resilience concepts.

This report focuses more specifically on supply chain security concerns – in particular food, water, and pharmaceuticals – and their management in relation to the country's general and long-term approaches. One major underpinning approach is the focus on the core principle of sector responsibility.

Water, food, and pharmaceutical supply chain issues are not considered major issues in Denmark and are tackled largely within the framework of local emergency plans. Since the Danish emergency response is very decentralized, the difference in scope and depth between different municipalities is quite large, and the issues that are considered important can vary considerably.

3.1.1 Incident driven policies

The Danish response system has undergone changes and evolved in response to changes in risk perception. The 9/11 terrorist attack in the US and later terrorist attacks in Madrid (2004) and London (2005) have led emergency responders to reconsider the consequences of terrorism. The Creutzfeldt-Jakob ('Mad Cow') disease outbreak that led to a ban of UK meat from 1996-2006 and the killing of 4.4 million animals considerably influenced how Denmark addresses similar issues. Denmark being on the supply side of the supply chain

is dependent on the world trusting Danish meat and dairy production. The EU legislation in the wake of the UK crisis, which banned the use of all kinds of protein in animal feed, was considered instrumental in this regard.

Import bans have had an impact on Danish agricultural export, and, over the years, new monitoring systems and guidelines have been installed so that any outbreak can be controlled and sources of outbreak can be identified as soon as possible. Given that Denmark is a big exporter of agricultural products, ensuring and maintaining confidence in the Danish agricultural system is vital, and for that reason new detection systems have been put in place. These systems are today recognized as being 'state of the art' and some of the best in the world.

In addition, a series of floods and extreme weather situations have triggered changes in the Danish crisis management system; however, water and food supply chains have not specifically been addressed.[107]

3.1.2 Future concerns

A major future concern is the impact of climate change. Climate change cuts across and affects all supply chains. Models have been made by the Danish Metrological Institute that show the impact of increased flooding, storms, and expected rainfall, and these models are used to estimate the risk for different areas in Denmark. As a result of global warming, atmospheric concentration of water vapor has increased since the temperatures are rising. Climate model calculations indicate that the global mean precipitation will increase by around 2 percent, and that the number of heavy precipitation events will increase by about 7 percent for every degree the air temperature increases.

More extreme weather events, both in terms of heavy rain fall and storms, will have greater impact on Danish infrastructure, which in turn may lead to problems with getting food and clean water to people isolated due to infrastructure collapse. These developments will make new demands on building design and construction, among other things. The Danish municipalities are engaged in a process that will make them better able to handle the consequences of extreme weather. This preparation includes action plans for climate adaptation, changing building regulations, specific measures in relation to sewers, storing water, and expansion of pumping capacity and other resources relevant equipment. There are also initiatives related to early warning, prevention, and mitigation of flood risks among state and regional authorities, in business, in academia, and in NGOs.

Apart from the impact to and on infrastructure, climate change is also expected to carry more vector borne diseases that may affect the agricultural industry. It is estimated that climate change and globalization may contribute to the risk of

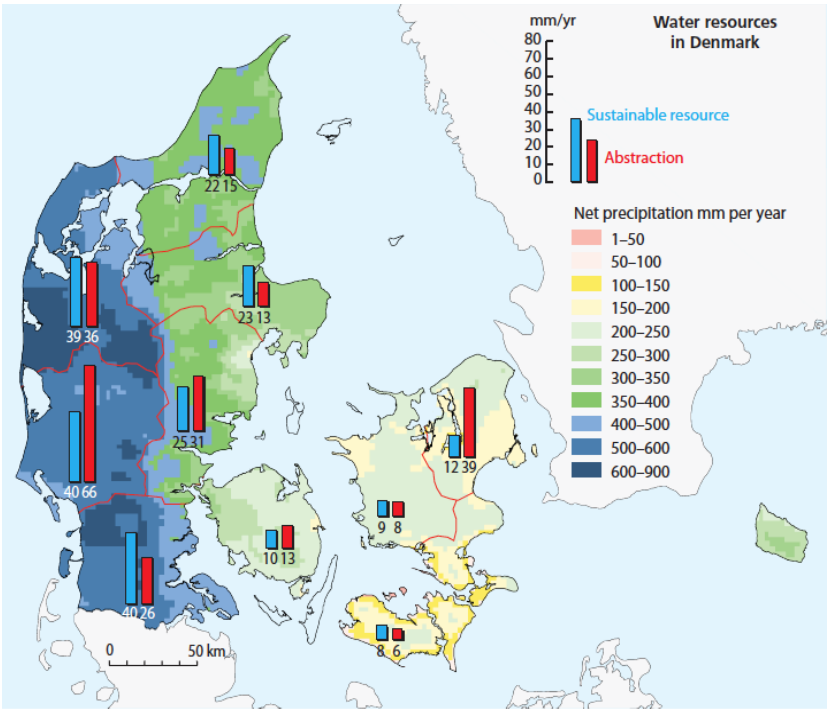
[107] Danish Emergency Management Agency : Nationalt risikobillede 2013

the introduction of new diseases in Danish livestock herds, and that this risk will increase in the coming years[108].

As noted in the National Risk Profile (NRB), infrastructure costs and economic costs related to export bans are in general considered the biggest concerns.

3.2 Drinking water

3.2.1 Overview – current situation and upcoming trends



Map of water resources in Denmark (Source: GEUS - Danish Ministry of the Environment, *Water supply in Denmark*: 4)

According to the Danish Nature Agency, 99.9% of the Danish drinking water supply comes from groundwater[109]. This makes Denmark one of very few countries in the world to be able to base almost 100% of its drinking water from groundwater[110]. It is estimated that around 800 million m3 of water is extracted annually, with groundwater recharge averaging 100mm per year, varying within the range of 50-350mm[111].

[108] Danish Emergency Management Agency : Nationalt risikobillede 2013
[109] Rent Drikkevand:3
[110] Dugfriske Fakta:1
[111] Hydro-mapping:1

The water supply structure is highly decentralized: approximately 2,600 public waterworks supply five million inhabitants, while the remaining approximately 0.4 million inhabitants use water from approximately 70,000 private wells[112]. Bottled water consumption being amongst the lowest in the EU, with only one fifth of the EU average[113].

As such, any disruptions of local supply chains constitute a limited threat and can with relative ease be mitigated. Locally decentralized authorities and standby units structure and draw up contingency plans. Nevertheless, the close proximity of waterworks and independent wells with access to clean groundwater allows for quick supply and high response flexibility thus mitigating issues of widespread disruption of supply chains. The unlikelihood of widespread domestic disruptions has consequently been subject to less policies and national contingency plans. Rather, the local authorities and independent waterworks coordinate and structure stand-by units on an ad-hoc basis.

Due to high standards of access, local responsiveness, close monitoring and improbable case of potential instantaneous disruptions on a large scale, the focus has been directed towards external gradual threats and the incremental disruptions caused by contamination from agriculture and changes in groundwater infrastructure.

In an article by GEUS (the Geological Survey of Denmark and Greenland – a part of the Danish Ministry of Energy, Utilities and Climate), two major challenges for the Danish water supply are listed as being: (1) regulation of drinking water abstraction; and (2) contamination/pollution:

“Since the 1970s one of the biggest challenges for water resource planning and administration has been to regulate the abstraction of surface and groundwater to an acceptable level (…) another big challenge for the water supply has been pollution of well fields with nitrate from farming, chemicals from old waste dumps and oil tanks, toxic materials from enterprises, and pesticides from urban areas and farmland.”[114]

Regarding pollution of groundwater, one of the main challenges has been nitrate and its concentrations. In 1987, this issue led the Danish parliament to approve the Action Plan for the Aquatic Environment (APAE), which aimed to reduce nitrate leaching into the water, for example from surrounding soil. This initiative was later followed up by APAE II in 1998 and APAE III from 2003 covering 2005-2015. The latter being supplemented by the Green Growth Plan of 2009.

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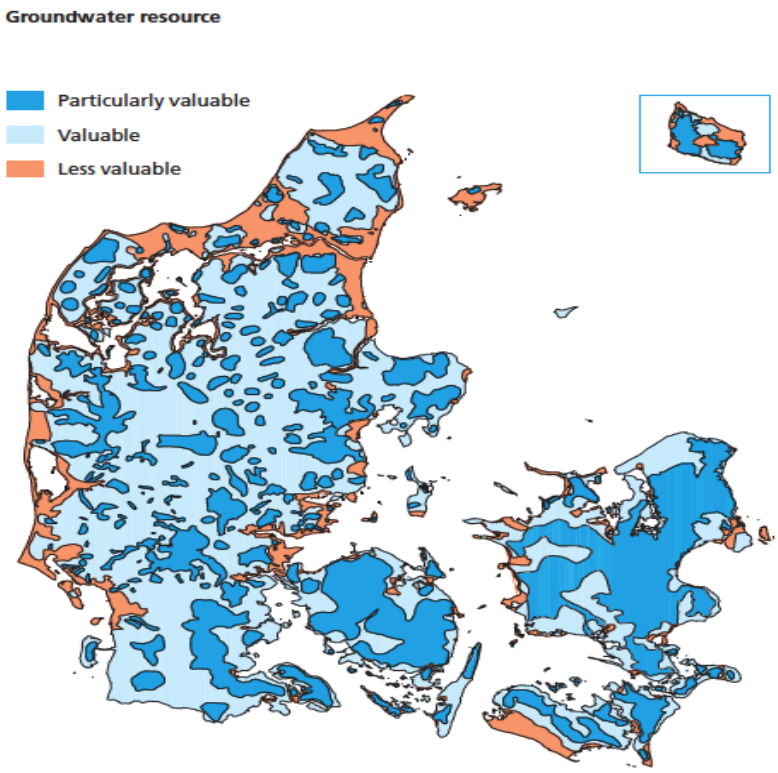
[112] Nature Agency 2012
[113] J. Schullehner, B. Hansen: Nitrate exposure from drinking water in Denmark over the last 35 years, Environmental Research Letters 2014
[114] GEUS:1

3.2.2 Ensuring good quality in groundwater

There is a risk of over-exploitation of the groundwater, particularly in the eastern part of the country. This is a problem because shallow groundwater usually experiences significant problems in quality, which makes it unfit for drinking (Vandmodel). However, it should also be noted that groundwater extraction has been reduced by more than a third within the last 20 years[115].



Map of groundwater resources in Denmark (Source: GEUS - Danish Ministry of the Environment, *Water supply in Denmark*: 4)

3.2.3 Structural, organizational and legislative foundation

The main responsibility for managing and maintaining the framework for the drinking water supply chain lies with the Danish Nature Agency (which is organizationally under the Ministry of Environment and Food). The APAE III and the Green Growth Plan of 2009 form the legislative foundation. The counties themselves are responsible for the security of the supplies locally. The operation of the water supplies is in both public and private hands. Responsibility for preventing contamination and pollution is split between the Danish Environmental Protection Agency, the Danish Nature Agency, the regions, and the counties.

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[115] Vandforsyning.

Community and private initiatives are an integrated part of securing the water critical supply chain. The operations of the water supply chain are in many instances private, either as a union of private drinking water companies, or as private individuals .

Denmark also observes the EU Drinking Water Directive, concerning the quality of drinking water. Denmark's close monitoring procedures (especially regarding contamination and general water supply) have led to bilateral, Nordic, and international collaboration.

It is the responsibility of the Minister of the Environment to make a flood risk assessment for each river district. Reassessment of flood risk and the identification of risk areas must take place every six years. The assessment of flood risk includes a description of historical floods, which have caused widespread damage to human health, the environment, cultural heritage and economic activity, and an assessment of the damage, as well as conducting an estimate of similar future events, and its consequences.[116]

The effectiveness of existing human-made flood defense infrastructures, the impact on populated areas, areas of economic activity, and long-term developments can thus be assessed. This estimate tries to take the issue of climate change into account, as much as is possible.

According to the National Risk Profile (NRB), the main risk to water is assumed to come from:

- Contaminating drinking water, as part of a terrorist action;
- Floods contaminating water supply with sewage water; and
- Accidents contaminating water supply.

3.2.4 Strategies for dealing with disruptions in the water supply chain

Strategies for dealing with water supply disruption in Denmark are as follows:

- The scope of the problem, duration and consequences are analyzed.
- A plan to obtain/acquire water is agreed upon and implemented.
- Consumers and the media are informed (e.g. via a communication plan).

Approaches also include:

[116] Bekendtgørelse af lov om vurdering og styring af oversvømmelsesrisikoen fra vandløb og søer 03-07-2013

- Establishment of temporary supply connections in the form of tubing or pipes are connected to neighboring waterworks. This option requires both the supplier and recipient to have a pre-established connectivity in the event of an emergency so their respective wiring or connection can be made available via fire hydrant.
- Irrigation drills can only be used for the supply of drinking water, after making an analysis of water and bacteriological factors, which takes 3 days. This work is more appropriate for longer-term emergencies
- Trucks can bring water in transported from another water supply system.
- In the case of prolonged power failure, for water companies who do not have an emergency generator, a mobile generator can be considered. However, it is forbidden for water works to pump drinking water to consumers if the sewage management pumping stations do not work due to a power failure.

Water can be made available via:

- Installation of portable containers
- Deliveries in cans
- Installation of temporary pipes (connections)
- Emergency supply from 2 wells at the waterworks (12 m3 / hour)
- Emergency Management Agency vehicles and staff
- Use of private carriers with water tanks approved for food (e.g. breweries).

3.3 Food

3.3.1 Overview – Current situation

While Denmark is not one of the biggest agricultural producers in the world, relatively speaking it is a large producer. Per capita, Denmark is a very big producer, and it produces more than twice as much pork as Spain, the second biggest producer in the world. Denmark is a net exporter of many types of food and consequently food security has been on the top of the agenda. Nevertheless, agriculture is still a major economic and cultural factor in the Danish society and although employment has steadily decreased.

In 2010 Denmark's agro export contributed with 40 billion Danish crowns to the national budget. Yet it is estimated that 25% to 50% of the food consumed in Denmark is imported. The export numbers are more reliable: 80% of the pig meat and 60% of the dairy products are exported. One crucial factor is the import of soy beans (primarily from Brazil), which is an important protein source for the pig industry. This makes the Danish pig production very

vulnerable to fluctuations in oil prices and climate change in South America, among other things. There is a number of research projects currently working on substitute crops for the pig industry, which is estimated to consist of 20 million pigs.[117]

Access to the European 'inner market' is vital for the overall Danish import/export of foodstuff, and the major Danish food companies (Arla, Danish Crown and DLG) have been successful in getting substantial market shares in the emerging economies of the BRIC countries as well as the Middle East (in particular, Arla). Japan is the single biggest export partner for the Danish pig industry.

Yet food production costs in Denmark have been less competitive, in part due to general income development, and this has led to an increased emphasis on technological developments and measures to increase production and cost-effectiveness.

In the previous government's (2011-2015) political manifesto[118], a significant part was devoted to the agricultural situation. The coalition of parties coming into government pledged to make the Danish food production 'greener', setting ambitious goals for organic production and consumption for the next four years. In addition, environmental concerns were raised, and stipulations for using more effective agricultural tools were made.

A commission[119] was appointed to analyze and give advice on how to achieve these political goals. In June 2012 a preliminary 'status report' was made public. This 1200 page report[120] provides a good overview of Denmark's food production as well as its potentials and challenges, including climate change predictions and food security concerns. On December 11, 2014, the government passed the Agricultural Act.[121] This new Act included a series of legal liberalizations and deregulations (e.g., purchasing and owning farm land as well as regulations for animal farming and agricultural workers).

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[117] http://www.maskinbladet.dk/artikel/protein-raps-skal-aflose-importeret-soja

[118]http://www.stm.dk/publikationer/Et_Danmark_der_staar_sammen_11/Regeringsgrundlag_okt_2011.pdf

[119] http://www.naturoglandbrug.dk

[120] A link to this report is included in the list of references.

[121] The government had been in harsh opposition to the previous government's initial liberalisation of the Agricultural Act: L 39 2010, even publicly 'promising' to abolish the Act when they came to power. However, the new Act did not include any of the recommendations from the Commission's report and was a further liberalisation and deregulation of food production, in an attempt to attract external capital. It was further liberalized by an amendment on January 1, 2015. For more on this, see http://naturerhverv.dk/landbrug/arealer---og--- ejendomme/landbrugsloven/

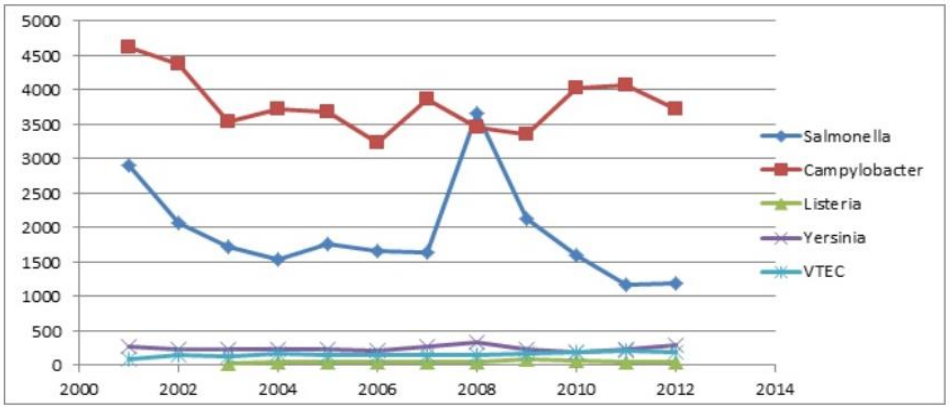
The current government (taking office in 2015) merged the Ministry of Food, Agriculture, and Fishery with the Ministry of Environment, forming the Ministry of Food and Environment. In addition, it has made efforts to allow farmers to produce more[122] and has liberalized the legal framework for food production in Denmark.

According to the National Risk Profile (NRB), the main risk to food is assumed to come from:

- Food security zoonoses (diseases): The type of diseases, which is estimated to have the greatest risks are: classical swine fever, African swine fever, foot-and-mouth disease and bird flu. It is traditional and exotic diseases that still seem prevalent in several countries, and are regarded as permanent, long-standing risks.
- Hurricanes destroying infrastructure

3.3.2 Past incidences

Import bans have had an impact on Danish agricultural export and thus practices have been changed. Over the years, new monitoring systems and guidelines have been installed so that any outbreak can be controlled and sources of outbreak can be identified as soon as possible.



Number of outbreaks (Source: SSI Statens Serum Institute)

When an outbreak occurs, control measures to combat the disease and stop the spread of infection in all stages of production from farm to table set in, including the killing of animals on infected farms, ban on movement of animals and food in the whole or part of the country, increased biosecurity demands on farms, and vaccination of livestock.

[122] http://landbrugsavisen.dk/økonomi/eva---kjer---giver---landmand---penge---tilbage---og---fjerner---særkrav and http://landbrugsavisen.dk/kvæg/lf---dansk---enegang---hjalper---hverken---miljo---eller---landbrug

Table 4.1: List of major food security incidents

Year	Notable incidences	Origin of major impact
1998	Classical swine fever	North Carolina
2001	Foot to mouth disease: several countries ban meat import from Denmark although Denmark was later cleared	Great Britain, France Netherland, Ireland
2005-06	Bird flu found in Denmark impact 330 million Danish crowns.	Indonesia
2009	Classical swine fever	Mexico
2008	Big outbreak of Salmonella Typhimurium U292	Denmark

3.3.3 Structural, organizational and legislative foundation

The Danish Parliament passed the Contingency Act (Beredskabsloven)[123] in 1993, which has subsequently been amended approximately once every year since, including in 2014. The first paragraph stipulates that the Act: "(...) is to prevent, limit and comfort damages to people, buildings and the environment in case of accidents, disasters, acts of war or war-like situations."

The Minister of Defense is the governing authority and throughout the Act, the division of labor between the State's governing bodies, the different sectors of society and the regional authorities is explicated and the Danish Emergency Management Agency is specified as the central planning and coordinating body.

In the case of an emergency the National Operative Council (NOST) will be activated and they will coordinate the management of the crisis. The Act also stipulates that an evaluation institute is to be founded, headed by an evaluation

[123] https://www.retsinformation.dk/forms/r0710.aspx?id=123670

commission consisting of 3 members. This institute was abolished in 2014. There is no special mention about food supply measures.

The Ministry of Environment and Food was created in the summer of 2015 as a result of the fusion between the Ministry of the Environment and the Ministry of Food, Agriculture and Fisheries of Denmark.[124] The Ministry of the Environment and Food is responsible for administrative and research tasks in the areas of environmental protection, farming and food production at state level. At the regional and local levels, much of the administrative responsibility has been delegated to the municipalities. The ministry consists of four agencies and local centers across the country. Three independent appeal boards are also linked to the ministry.

The Department of Food Produce (Fødevarestyrelsen) has the predominant task for monitoring food safety both among producers and processed foods. The risk of an outbreak of disease in the Danish food sector, which is dominated by animal husbandry, is a major factor in the work done by the department.[125] This department primarily works with certification and food safety. There is a general plan on how to react, including where to get information about supply and consumption needs. The farmer's organization (Landbrug&Fødevarer), which is a private enterprise, supplies this information.

The Department of Food Produce has an emergency department.[126] In 2002 the department did a thorough assessment of the chain of command and emergency plans surrounding the food sector in the case of a number of emergency scenarios. The report describes in detail how the authorities should act. It is an example of Danish food-related contingency planning.[127] The department is also part of a European alarm network called RASFF. This system is used to alert other member states and trading partners if contaminated food is detected or if food-related diseases have been identified and confirmed by the veterinary authorities.

The Danish Veterinary and Food Administration (DVFA) under the Ministry of Environment and Food is the authority in charge of the food emergency response system, and the DVFA is the Danish focal point for the European

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[124] http://mfvm.dk/english/

[125] The seriousness of this potential threat is illustrated by a communiqué from the Ministry of Agriculture, in which the emergency plan for an outbreak of swine plague is discussed in the Parliament Committee on Food (800 people are assigned to the plan): http://www.ft.dk/samling/20141/almdel/flf/spm/107/svar/1184753/1439737.pdf

[126] http://www.foedevarestyrelsen.dk/Foedevarer/Foedevareberedskab/Sider/Forside.aspx

[127] http://www.foedevarestyrelsen.dk/Publikationer/Alle%20publikationer/2003002.pdf

early warning system - Rapid Alert System for Food and Feed (RASFF). DVFA is responsible for:

- Withdrawal of food, feed and food contact material
- Tasks for the European feed and food alert system "RASFF"
- Water and food borne diseases
- Civilian preparedness

DVFA has long-term strategic priorities and objectives based which are stipulated in the DVFA business strategy 2013-2016 (Fødevarestyrelsens forretningsstrategi 2013-2016).[128]

Monitoring and control of a number of serious diseases in domestic and wild animals is done by international rules and guidelines set by the EU and the World Organization for Animal Health (OIE). The rules are directed by Danish law and adapted to Danish conditions.

According to article 59 the Minister of Food, Agriculture and Fishery (now the Ministry of Environment and Food) can determine the rules and agreements (including decision-making power) necessary to secure the optimal application and allocation of foods, avoid contamination, and secure the public's access to food in case of emergencies and disruptions such as war, crisis and/or catastrophes.

The legislative foundation includes:

- Food Agreement II on food control applied during 2011-2014.
- Veterinary Agreement II on control in the veterinary field in force 2013 to 2016.
- Regulation (EU) No 652/2014 of the European Parliament stipulates provisions for the management of expenditure relating to the food chain, animal health and welfare, and relating to plant health and plant reproductive material.
- Commission Regulation (EU) No 16/2011 of 10 January 2011 stipulates implementing measures for the Rapid Alert System for Food and Feed.

International networks

[128]http://mfvm.dk/fileadmin/user_upload/FVM.dk/Dokumenter/Ministeriet/Om_ministeriet/oekonomi/resultatkontrakter/Foedevarestyrelsens_resultatkontrakt2015.pdf

Through its membership of EU Denmark is also a member of EFSA, the institution that coordinates food safety and security measures across the union. A strategic policy paper from 2003 outlines the need for specific contingency plans, in the case of a pan-European emergency situation.[129] The focus in EFSA is on every day food safety issues and little is directly stated about emergency food supply chains. A recent Danish policy paper has been circulated that raises concerns about several issues related to the food safety policies of EFSA.[130]

Denmark is a NATO member, and the alliance has a strategic planning group called Public Health and Food/Water Group but strategic emergency plans emanating from NATO are confidential.[131]

Denmark is also a member of the WTO, which means that Denmark is legally obliged to liberalize its framework for trade, including trade with food produce. The policy paper mentioned above highlights some of the problems arising from this obligation, but again the main focus is on the safety and certification of the food consumed in Europe.

3.3.4 Major stakeholders

Denmark's food sector is dominated by three large cooperatives: Arla (dairy products), Danish Crown (meat processing industry) and Dansk Landbrugs Grovvareselskab (DLG, which sells animal feed, seed grain farming supplies, vitamins and minerals). They are all owned by the farmers in a traditional coop structure. However, there are many foreign producers and shareholders. For example, Danish Crown changed its ownership structure in 2013 and the majority of its processing plants are in Poland and Germany. The Danish milk producers account for only 2/5 of the total amount of producers who own Arla and they are spread across seven countries.[132] The conventional farmer's organization (Landbrug&Fødevarer) and the large Danish supermarket chains (e.g., Coop which supplies about 30% of the food consumed in Denmark[133]) are also important stakeholders in the food supply chain.

[129]http://www.efsa.europa.eu/sites/default/files/scientific_output/files/main_documents/scdoc_advice02_crisis_activities_en%2C0.pdf
[130] https://webapi.eesc.europa.eu/documentsanonymous/eesc.../content
[131] http://www.coemed.hu/coemed/news---a---events/143---public---health---and---foodwater---group---phfwg---seminar---8--10---november---2011
[132] http://group.dlg.dk/da/koncernstruktur/
[133] Karsten Roesgård telephone---interview 18/9/2015

3.4 Pharmaceuticals

In 2009, the swine flu pandemic A (H1N1) hit Denmark. By mid-2009, 4642 people were infected and 21 people had died. Despite the relatively limited health consequences, an extensive crisis management response was required by the Danish authorities. More recently, the risk of Ebola spreading from Africa has been of some concern, as well as the revival of diseases like cholera or typhoid, earlier considered gone in Denmark

Antiviral medicines are an important part of the Danish pandemic emergency response preparedness framework. Antivirals cannot stop a flu pandemic, but they can be used to slow the spread, protect the vulnerable against serious illness and death, as well as treat the sick until a vaccine is available. The anti-viral medicines are especially important in the first half year from when a new pandemic virus occurs to and until a successful vaccine is found, and are produced in quantities enough to vaccinate large groups of the population.

3.4.1 Structural, organizational and legislative foundation

The main responsibility for managing and maintaining the framework for the emergency planning related to disease prevention, e.g. in the case of a pandemic, lies with the Danish Health and Medicine Authority (DHMA). They work together with among others, the World Health Organization (WHO), on monitoring the spread and risk of the outbreak of diseases worldwide.[134]

The Danish Health and Medicine Authority provide the national guidelines for municipalities and the Danish regions. The latter being in charge of the hospitals, as well as guidelines for doctors and health practitioners.

In case of an emergency, it is expected that around 2/3 of the patients in hospitals will be released to make room for the acute patients.

The legal basis for emergency planning in the hospital sector is - in addition to the Crisis Management Act - the Hospital Act, Law on Health Insurance, and the Executive Order on planning of the pre-hospitalization efforts and training of ambulance staff.

The Danish Health and Medicines agency (DHMA) has the sectorial responsibility within the medicinal sector and subsequently the strategic and emergency managerial responsibility in cases of supply chain disruptions on a national level. In scenarios through which the local emergency-response units in the municipalities cannot cover a given supply related challenge, DMHA the

[134] The WHO Global Influenza Surveillance and Response Network (GISRS), consisting of 110 laboratories in 83 countries (WHO National Influenza Centres, NICs) and four WHO Collaborating Centres for Influenza Reference and Research (WHO CCs) in four continents North America, Europe, Asia and Australia.

agency can activate 2 statutory announcements; 1) Distribution of medicine 2) Rationing of medicine and medical equipment.[135]

In accordance with the prevailing contingency plans local hospitals, doctors, and pharmacies should work continuously to ensure that sufficient hospital medicine and vital pharmaceuticals (such as injection and infusion liquids) remain at a sufficient capacity. This entails in-house basis production at the hospital pharmacies in the Capital Region of Denmark, the North Denmark Region, the Region of Southern Denmark, and the Region Zealand.

The basis pharmaceutical aids needed for such local production is largely purchased and provided by the industry. Major Danish pharmaceutical companies play a role here, but so do Fresenius Kabi in Norway and B.Braun in Germany. Nevertheless, the huge presence of local developers and facilities at domestic pharmaceutical companies, such as LeoPharma and NovoZymes, provide a potential platform for domestic provision and development of basis medicinal treatments. Additionally regions such as Region Zealand have suggested retaining such basic medical components for production from local providers in order to mitigate issues of supply in crisis situations.[136]

The latter distribution and stockpiling of medicine is widely dispersed throughout the network of local pharmacies and doctors. The Danish stockpiles for distribution consists of:

- Approximately 300 pharmacies
- Hospital pharmacies in the regions
- 2+ Wholesalers with sub-developers
- Pharmaceutical companies
- Producers – industry and pharmaceutical hospitals.[137]

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[135] Nina Egtved Knudsen,Medical inspector – Department of Medicinal control and law enforcement. "Lægemiddelberedskabet – Hvad bør planlægges for og hvordan?" (2011, 27th September) http://sundhedsstyrelsen.dk/~/media/5D5FD31005294E47B669A02CBE54983B.ashx

[136] http://polweb.vordingborg.dk/open/Sundheds-%20og%20Psykiatriudvalget%20(%C3%85ben)/2015/06-08-2015/Referat%20(%C3%85ben)/06-08-2015%20-%20Bilag%2008.09%20Bilag%206%20-%20Plan%20for%20l%C3%A6gemiddelbered%E2%80%A6.pdf?Mobile=1&Source=%2F_layouts%2Fmobile%2Fview.aspx%3FList%3Da9cd625e-b323-44b1-936e-e82958f1ab90%26View%3Da167921e-9903-4fb2-bf58-63847d992ee0%26RootFolder%3D%252Fopen%252FSundheds-%25200g%2520Psykiatriudvalget%2520(%25C3%2585ben)%252F2015%252F06-08-2015%252FReferat%2520(%25C3%2585ben)%26CurrentPage%3D1

[137] Nina Egtved Knudsen (IBID 2011)

All of which have 24 hour on call or on-duty schedules, and all pharmacies get supplies once a day which demand and distribution can be closely coordinated and monitored.

Production of oral fluids from oseltamivir raw materials can be established if large quantities of antivirals are needed. Production is prepared through contracts with the Capital Region Pharmacy and a pharmaceutical company. During the pandemic, in 2009, this kind of production of oseltamivir from raw material was tried and used to treat influenza patients in a hospital ward, with good results.138 In the case of Tamiflu, the Danish Health and Medicine Authority advise that a national stockpile corresponding to a total coverage of about 6% of the population is maintained.

Similarly, preventive medicine is stored for approximately 150,000 persons, of whom work and are in charge of vital functions in the Danish health system.

3.4.2 Key stakeholders, partnerships and networks

Key stakeholders in the supply chain of pharmaceuticals are: the Danish government, regional hospitals and healthcare professionals at the local level, private companies, the pharmaceutical industry, medical staff, and patients. Networks include: WHO, the EU's Early warning Response System (EWRS), and PROMED.

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138 Sundhedsstyrelsen: beredskab for pandemisk influenza, del I: National strategi og fagligt grundlag 2013

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Informants

Mie Blom, staff in Landbrug&Fødevarer's contingency office

Klaus Bolving, previous head of the Danish Defence Academy, today security consultant

Rasmus Dahlberg, Ph.d. fellow at the Danish Emergency Management Agency/ University of Copenhagen

Peter Laugesen, senior staff member at the Department of Foodproduce

Ole Madsen, security office at Arla

Maximilian Ritzl, senior staff member in the Danish Emergency Management Agency

Representatives from DEMA

Representatives from Danish Veterinary and Food Administration

Representatives from Danish Health and Medicines Authority

Representatives from the Ministry of Environment and Food

Representatives from Danish Energy Agency

Karsten Roesgård, Emergency office at Coop, Danish Supermarket

4. Country Report – Iceland

Jón Örvar G. Jónsson

School of Engineering and Natural Sciences, University of Iceland

4.1 Executive summary

In Iceland there are two levels of administration: municipal and central. This is in contrast with many other countries which have three levels: municipal, regional and central. In Iceland the security of supply chains falls under the authority of the Civil Protection and Security Council (CPSC) and is comprised of various stakeholders from the government as well as the public and private sector[139]. The country's vital infrastructure (Mikilvæg Innviði Samfélagsins) is a part of the government policy on civil protection and security, which is drawn up by CPSC. The Ministry of Interior is the supreme authority and the Civil Protection Department of the National Commissioner of the Icelandic Police that coordinates the security of the supply chains. The assessment of what is vital to the security of Icelandic society is based on the analysis of the Icelandic Risk Assessment Report (IRAR) published in 2009[140]. Based on the analysis of IRAR the main security risk and threats for Iceland have been grouped into three[141][142]:

- Group one: Major accidents in the Artic; Cyber-threats and sabotage[143]; Natural disaster
- Group two: Organized crime; Financial/economic security; Food security; Public health and epidemics
- Group three: Military threats; Terrorism

This country reports looks the security of food, drinking water and pharmaceutical supplies that fall with group two. According to the proposed security strategy for Iceland vital infrastructure are prioritized in Iceland and are matters that need full attention.

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139 Civil Protection Act No. 82/2008 Article 4.
140 Utanríkisráðuneytið (2009) Áhættumatsskýrsla fyrir Ísland – hnattrænir, samfélags- og hernaðarlegir þættir.
141 Alyson J.K Bailes and Kristmundur Þór Ólafsson (2014) Developments in Icelandic Security Policy. Stjórnmál & stjórnsýsla 2. 10.
142 Tillaga til þingsályktunar um þjóðaröryggistefnun fyrir Ísland.
143 The issue of danger to food, water and pharmaceutical supplies due to Cyber Crime or sabotage is not address in the government Information and internet security policy for 2014-2015 Sigurður Emil Pálsson - Ministry of Interior

4.1.1 Food

Due to its geographical location and northerly latitudes, Iceland is highly reliant on importing food and supplies related to domestic food production. If importation would cease, the country would be able to provide only around half of the calories needed for its inhabitants. In the case of natural disasters, where Iceland would have difficulties of providing enough food to its citizens, Iceland's NATO partners would be able to help with disaster assistance and thus supplies.[144]

4.1.2 Drinking water

Iceland is one of the richest freshwater countries in the world with estimate of around 600 thousand m3 per person per year. In addition, there is high availability of good quality groundwater. The goal of Icelandic regulations is to protect public health by ensuring that drinking water is fresh and clean. There are no foreseen shortages of water in the country.

4.1.3 Pharmaceuticals

Iceland is really a small market for pharmaceuticals and is very reliant on imports. It has limited stocks, about one month's worth, and currently has limited capabilities to produce its own supplies. In the case of natural disasters, where Iceland would have difficulties in providing enough medical supplies for its citizens, Iceland's NATO partners would be able to help with disaster assistance and thus supplies.[145]

4.2 Overview

The withdrawal of US stationed forces from Iceland in 2006 marked the beginning the development of Iceland's national security concept. Icelanders had long relied on the US after the post-world war period for its security and defense.[146] In 2007 the current Minister of Foreign Affair appointed an independent commission to make a national risk assessment looking at military and non-military, external and internal threats. The report known as the Assessment Report (ICAR) was published in 2009 and covered, among other things, the issue of vital infrastructure: food, drinking water and public health security. In 2008, by the request of the Iceland government, the Chief Epidemiologist for Iceland and the Department of Civil protection and Security at the National Commissioner of the Icelandic Policy had published a national

144 NAT0 (2001) Nato roles in disaster assistance
http://www.nato.int/eadrcc/mcda-e.pdf
145 NAT0 (2001) Nato roles in disaster assistance
http://www.nato.int/eadrcc/mcda-e.pdf
146 Alyson J.K Bailes and Kristmundur Þór Ólafsson (2014) Developments in Icelandic Security Policy. Stjórnmál & stjórnsýsla 2. 10.

contingency plan regarding the possible outbreak of a world-wide influenza pandemic.[147] The influenza report contained processes regarding the security of food, drinking water and pharmaceutical supplies. Other events like the 2008 financial and economic meltdown and the three major volcanic eruptions (Eyjafjallajökull, Grímsvötn, and Nornahraun) since then have further spurred the discussion regarding national security and thus the protection of vital infrastructure. In 2012, a cross parliamentary committee started working on guidelines for a national security policy for Iceland and now there is a policy proposal before the Parliament[148] marking the first official security strategy of Iceland. An important part of the proposed official security strategy is the current government policy in Civil Protection and Security.[149] The government policy is framed by the Civil Protection and Security Council (CDSC). Its mandate comes from of the Civil Protection Act nr. 82/2008. The aim of Civil Protection Act is:

> "to prepare, organize and implement measures aimed at preventing and, to the extent possible, limiting physical injury or damage to the health of the public and damage to the environment and property, whether this results from natural catastrophes or from human actions, epidemics, military action or other causes, and to provide emergency relief and assistance due to any injury or damage that may occur or has occurred."

In a meeting in 2009 the CDSC commissioned the Minister of the Interior and relevant stakeholders to start drafting a policy on the civil protection and security in Iceland. The result from this work was finished in June 2015 and published by the Ministry of Interior (Stefna í almannavarna- og öryggismálum ríkisins 2015-2017). The government policy covers risk analysis, emergency preparedness and responses regarding various factors that can compromise social and civilian safety. The policy included strategic emphasis in specific themes along with 42 measures for implementation. Among the factors covered was securing social vital infrastructures, including: health care, food security and food safety, and drinking water safety.[150]

According to the Civil Protection Act[151] the state shall be responsible for civil protection in Iceland, and the local authorities are responsible for civil

147 Almannavarnardeild Ríkislögreglustjóra og sóttvarnarlæknir (2008) Viðbragðsáætlun vegna heimsfaraldurs inflúensu.
148 As of April 2015.
149 Tillaga til þingsályktunar um þjóðaröryggistefnun fyrir Ísland.
150 Innanríkisráðuneytið (2015) Stefna í almannavarna- og öryggismálum ríkisins 2015-2017.
151 Civil Protection Act No. 82/2008

protection at the local level. According to the act, each municipality has a civil protection committee which shall work on risk assessments and response plans in their respective administrative areas in collaboration with the National Commissioner of Police. During crises the members of the committee have greater authority to take the necessary decisions for civil protection.

According to the Civil Protection Act there are certain civic duties in the times of peril when for example persons might be asked to assist with civil protection work without recompense.

4.2.1 Strategic foresights

According to the Civil Protection Act the government policy of civil protection and security shall be drawn up by the CDSC for a three year period. As for long term policy for the next 15 to 20 years, the proposal on the national security is Iceland's first policy on national security matters after the withdrawal of US forces and this marks the beginning of long term strategic foresight of Iceland security.

4.2.2 Best practices

There is a partnership between the clean water providers and 112 emergency phone service in Iceland where reports about possible water pollution in protected areas are sent directly to the water providers.

4.2.3 In short: Future outlook

Iceland has a very sensitive situation regarding the security of both food and pharmaceutical supplies as the country is heavily reliant on imports. The supply of clean water is sufficient. There has been a lack of long term strategy regarding the securing the vital infrastructure in Iceland. Recent developments like the proposed national policy on national security and the new policy on civil protection and security are steps in the right direction.

4.3 Food supplies – Food security and Food safety

4.3.1 Overview

Throughout its history Iceland has been marked with episodes of food insecurity. Up until the 18th century it was estimated that the carrying capacity of Iceland was not more than 50 thousand inhabitants.[152] Those days are long gone and after the second half of the 20th century domestic food production

152 Arnór Snæbjörnsson, Drífa Hjartardóttir, Eiríkur Blöndal, Jón Geir Pétursson, Ólafur Eggertsson og Þórólfur Halldórsson (2010). Skýrsla nefndar um landnotkun – Athugun á notkun og varðveiðslu ræktanlegs lands. Sjávarútvegs- og landbúnaðarráðuneytið. Reykjavík.

surpassed domestic consumption. The last 50 years have marked a substantial changed in Iceland's food consumption pattern. The country has been moving from towards greater diversity and more reliance on food that requires imported base ingredients.[153] At the same time the role of domestically produced food has diminished. This is partly due to developments regarding importation limitations, increased purchasing power of individuals, and a change in dietary habits.[154] Due to its geographical location Iceland is very reliant upon imports, both of food and food related supplies necessary for domestic food production, like equipment, fertilizer and oil.[155] Recent events like the 2008 economic meltdown and volcanic eruptions in 2010, 2011 and 2014 have shown how reliant the island is on foreign trade for its food security.

4.3.2 Current situation

Food and feed is imported to Iceland via airplanes and ships. Fresh fruit and vegetables arrive by airplane, and feed and food that have a longer shelf-life are transported by ship. Within the country, supplies are mostly distributed by road but there are also shipping lines that move products along the coastline, sailing both north and south around the island. The food and drink industry in Iceland comprises elements of food manufacturing and wholesale and retail supply chains. Historically the food market was dominated by wholesale suppliers but in recent years the Icelandic retail giants have been moving into the wholesale sphere as well.[156] Overall both the retail and wholesale markets are dominated by a few players. Food production is an important aspect of the Icelandic economy and the food and drink industry. In 2012 together they produced for an amount of ca 363 milliard ISK, which is around 49% of the total value of products sold in Iceland. As Iceland is one of the largest fishing exporters in the world, the value creation in the food and drinking industry is dominated by the fishing sector which creates 74% of its value.[157] Most of the fish is processed and exported either frozen, salted or fresh. In terms of export value, the fishing sector creates 42% while agriculture exports are around 2%.[158] According to several estimates, Iceland agriculture (table 1) can provide

153 Directorate of Health (2011) The availability for food from 1956 to 2010http://www.landlaeknir.is/servlet/file/store93/item15110/Faeduframbod.tafla5_1956_2010.xlsx
154 Alyson J. K Bailes and Orri Jóhannsson (2011) Food Security in Iceland. Stjórnmál & Stjórnsýsla 2. 7.
155 Utanríkisráðuneytið (2009) Áhættumatsskýrsla fyrir Ísland – hnattrænir, samfélags- og hernaðarlegir þættir.
156 Samkeppniseftirlitið (2012) Verðþróun og samkeppni á dagvörumarkaði.
157 Statistics Iceland. Manufactoring - 2012 http://www.statice.is/lisalib/getfile.aspx?ItemID=15179
158 Statistics Iceland. Trade in goods - 2012 http://www.statice.is/lisalib/getfile.aspx?ItemID=15131

around half (1282 kcal of 2400) of the average dietary calories needed per individual within the current system (table 2).[159]

Table 1 Icelandic domestic agricultural production[160]

Agricultural commodity	%
Grain (incl. seeds)	1
Feed plants	22.3
Vegetables and horticultural products	5.4
Potatoes (incl. seed potatoes)	1.6
Animals	35.3
Animal products	29.7
Agricultural services	0.6
Various activities	4
Total	100

Table 2 Food imports as % of total imports

Live animals	0
Meat and meat preparations	0.3

159 Alyson J. K Bailes and Orri Jóhannsson (2011) Food Security in Iceland. Stjórnmál & Stjórnsýsla 2. 7.
160 Statistics Iceland (2014) Icelandic domestic agricultural production.

Dairy products and eggs	0.1
Fish, crustaceans, mollusks etc.	1.8
Cereals and cereal preparations	1.5
Vegetables and fruit	2
Sugars, sugar prep. and honey	0.3
Coffee, tea, cocoa, spices	0.8
Animal feeds, excl. unmilled cereals	0.7
Miscellaneous edible products	1.2
Beverages	0.8
Crude animal and vegetable materials	0.4
Animal oils and fats	0.4
Fixed vegetable fats and oils	0.2
Animal/vegetable fats/oils, processed	0

4.3.3 Past incidents

Overall Iceland has enjoyed food security and food safety for the last decades but a series of events have put these issues into question. In 2009 the IRAR pointed out that Iceland is in a weaker position compared to its neighboring countries regarding food security. This came apparent during the financial meltdown in 2008 when there was a short term shortage of currency in the country and even though it did not comprise energy and food security, it became clear how dependent Iceland is upon imports. Not only for actual food but also for food supplies which the domestic food manufacturing needs. The agricultural sector needs oil, fertilizer and equipment to keep production going and so does the Icelandic fishing sector. According to IRAR, if the country would be closed off to international markets production levels would

substantially decrease. Iceland would though be able to produce and supply a minimum amount of food.[161] The issue of food security was also raised during the last three volcano eruptions when local food supplies ran out for a short time in some areas of the country and air traffic from Europe was limited.

The Farmers Association (FA) in Iceland has since 2009 raised the issue several times and has often put it into the context of Iceland EU membership application. The FA argued that the food security of Iceland might be threatened because of increased imports from the EU countries. According the FA argument, increased food import would mean that certain sectors of domestic agriculture would go out of business and the country would be even more reliant on imports because of that.[162]

In 2008 the Minister of Agriculture and Fisheries appointed a commission to report on the use and protection of arable land in Iceland. In 2010 the committee handed in the report and presented several comments regarding food security and land use. The committee pointed out there is more arable land than currently is in use, that the arable land use should be planned so it does not jeopardize good agricultural land, that the authorities should estimate how supplies should be secured into the future, and that the authorities should initiate work on food security.[163]

In 2015 the Minister of Agriculture and Fisheries appointed a commission to look at the potential for increased food production in Iceland.[164] The committee is supposed to hand in a report in late 2015. According to one of the committee members there are two potential lines of focus within the committee. One is to focus solely on food export; the other one is to focus more on increased food security in Iceland for the future.[165] What the outcome will be remains to be seen. Public awareness of food security issues is limited.[166] In most municipalities, supplies are only available for a few days at any given time due to the current flow of transport and just-in-time delivery of products. Before

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161 Utanríkisráðuneytið (2009) Áhættumatsskýrsla fyrir Ísland – hnattrænir, samfélags- og hernaðarlegir þættir.

162 Alyson J. K Bailes and Orri Jóhannsson (2011) Food Security in Iceland. Stjórnmál & Stjórnsýsla 2. 7.

163 Arnór Snæbjörnsson, Drífa Hjartardóttir, Eiríkur Blöndal, Jón Geir Pétursson, Ólafur Eggertsson og Þórólfur Halldórsson (2010). Skýrsla nefndar um landnotkun – Athugun á notkun og varðveiðslu ræktanlegs lands. Sjávarútvegs- og landbúnaðarráðuneytið. Reykjavík.

164 http://www.vb.is/frettir/hvernig-er-haegt-ad-auka-matvaelaframleidslu-islandi/115535/

165 Eiríkur Blöndal – Personal Communication – a member of the committee on the potential of increasing Icelandic food production

166 Halldór Halldórsson – Personal communication The chairman of association of Icelandic municipalities

the days of frequent road transports, there was more food in storage in small town in the countryside.

Because of its geographical and historical isolation and relatively few access points, the country has been free from many of the animal disease outbreaks that have hit Europe.

4.3.4 Upcoming trends

Climate change might affect Iceland food supplies but whether it is for the better or worse it is still not clear at this point. This has to do with increased overall temperatures so growing conditions in Iceland might improve. According to Iceland's Scientific Committee on Climate Change the overall benefit for agriculture might be positive and also for fishing. For example, new fish species (e.g., mackerel) have appeared in fishing grounds and it is believed this is due to changing conditions in the sea. There are also negative signs like the acidification of the ocean north of Iceland and increased frequency of weather extremities, both of which affect Iceland's food production capabilities.[167]

In Reykjavík's new municipal plan for 2010-2030, there are plans to encourage city farming and give individuals more opportunities to grow their own food. In the plan, an area on the outskirts of Reykjavík has been dedicated as a potential area for small scale agriculture and one of the goals of the Reykjavík municipal plan is to increase the number of farmers markets within the city.[168] Since around 2/3 of Iceland's population live in Reykjavík and neighboring areas, this might improve food production locally.

The Prime Minister of Iceland and the current government has shown interest in Icelandic food production especially with regards to agriculture and is of the opinion that there is an opportunity of Iceland as a food producer.[169] [170] [171]

There are also recent trends regarding relaxed quotas and taxation on food imports and the effects that they might have on domestic producers. Recent agreements between the Icelandic government and the EU[172] in these matters might ruin the Icelandic pork and chicken manufacturing industry according to

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167 Halldór Björnsson et. al (2008) Scientific committee on climate change.
168 Reykjavík Municipal plan 2010-2030
169 http://www.framsokn.is/news/vegna-upphlaups-um-loftslagsmal-og-matvaelaframleidslu/
170http://www.vb.is/frettir/hvernig-er-haegt-ad-auka-matvaelaframleidslu-islandi/115535/
171 http://www.rml.is/is/moya/news/ny-rikisstjorn-hyggst-studla-ad-aukinni-matvaelaframleidslu-a-islandi
172 http://www.atvinnuvegaraduneyti.is/sjavarutvegs-og-landbunadarmal/frettir/nr/8730

their spokesmen, and this move by the Icelandic government came as a surprise to many of them.[173] [174]

4.3.5 Structural, organizational and legislative foundation

The Ministry of Industries and Innovation is responsible for food safety and food security. Two ministers are responsible for the affairs of the Ministry of Industries and Innovation and Sigurður Ingi Jóhannsson, Minister of Fisheries and Agriculture, is responsible for the food sector. The lead authority within the government structure responsible for food security and food safety is the Icelandic Food and Veterinary Authority (IFVA). IFVA is an inspection and administrative body in the field of food safety, animal health and welfare, control of feed and fertilizers, plant health and water for human consumption. IFVA was created in from merger of several authorities and services dedicated to food and agricultural related inspection and administration. IFVA primary roles are:

- Food safety legislation and control
- Control of primary production of animal products, including fish and fish products
- Control of meat processing and dairy plants
- Import and export control of all foodstuffs
- Supervision of domestic food control by municipal authorities
- Animal health and welfare legislation and control
- Plant protection services
- Feed, seed and fertilizer services
- Meat classification services
- Administration and management
- Legislative foundation

The legislative foundation for IFVA is the act No. 167 from 2007. Iceland is not a member of EU, but is a member of the European Economic Area (EEA) through membership of the European Free Trade Association and as such is obliged to implement EU directives into national legislation regarding food safety. In the case of natural disasters, where Iceland would have difficulties of

173 http://www.ruv.is/frett/kjuklingabaendur-osattir-vid-afnam-tolla
174 http://www.vb.is/frettir/rekstargrundvollur-svinaraektar-i-uppnami/121007/

providing enough food to its citizens, Iceland's NATO partners would be able to help with disaster assistance and thus supplies.[175]

4.3.6 Key stakeholders, partnerships and networks

The key stakeholders in the Icelandic food supply chain are the Icelandic Farmers Association, the Ministry of Agriculture and Fisheries, the Ministry of Environment and Natural Resources, IFVA, Federation of Icelandic Fish Processing Plants, wholesalers, retailers and food manufacturers. IFVA is the national European Food Safety Authority (EFSA) Focal Point and Rapid Alert System for Food and Feed (RASFF) contact point.

Current, planned and proposed measures, policies and strategies for dealing with the current food supplies as well as temporary and longer term interruptions

The 2015 Policy on Civil Protection and Security lists measures regarding securing food supplies in times of crisis. It defines two measures regarding food supply: food security and food safety. In the report food security involves the access to sufficient, safe and nutritious food while food safety refers to the access to wholesome and safe food. Tables 3 and 4 list the issues regarding food security and food safety from this report. Civil protection in Iceland provides guidelines for companies and individuals regarding preparedness during times of crisis. This includes a list of equipment, stocks food, water and medicine and what to do during different situations; for examples, earthquakes, floods and volcanic eruptions.[176]

Table 3: Food Security – Modified from the Policy on Civil Protection and Security 2015-2017

Goal:	That there is an plan to ensure that there are enough supplies of healthy food and clean drinking water for at least six months
Responsibility:	The Ministry of Industries and Innovation
Project management:	Icelandic Food and Veterinary Authority

175 http://www.nato.int/eadrcc/mcda-e.pdf
176 http://www.almannavarnir.is/displayer.asp?cat_id=3

Key stakeholders:	The Ministry of industry and Innovation, Icelandic Food and Veterinary Authority, Icelandic Food and Biotech R&D, Marine Research Institute, The Directorate of Fisheries, The Institute of Fresh Water Fisheries, municipalities, Icelandic Coast Guard, The Environment Agency of Iceland, Fire and Rescue Services, Iceland Construction Authority, as well as primary and secondary food producers, *manufactures*, and suppliers
Threats:	Natural disasters, climate change, pollution, human error, vandalism, oil fertilizer shortage, isolation of the country, closing of borders, as well as shipping and flight routes, disruption in import of food and materials, economic collapse, human and animal diseases, pollution and toxic accidents, and state of war
Mitigation:	Laws and regulation. Monitoring of land and sea. Securing key supplies for food production (oils, equipment, medicine etc.). Be prepared to guide people toward food self-sufficiency
Vulnerability:	Imports of food and supplies, retail supplies, human error
Responses:	Rationing of food and fuel. Administrating the allocation of feedstuff. Monitoring the environment (sea, land and air) and determining if food is safe to consume.
After an event:	To keep food production online. Monitor supplies in slaughterhouse and with companies in the sea food industry. Inventory accounting - overview of supplies. Food and clean water is available. Securing distribution. Securing supplies for the production of foodstuff from the sea and the land.
Response system:	Supply system, response plans.
Plans for the next three years:	• Legislation needs to be in place for the following: food storage, food distribution, energy and monitoring. • Response plan for the Ministry of the Industries and Innovation

	• Response plan for food shortage in collaboration with suppliers • Gathering and dissemination of information • Monitoring agencies should have plans on how to react in a crisis • Make an energy plan regarding economic defense, supplies and emergency transport to and from the country

Table 4: Food Safety - Modified from the Policy on Civil Protection and Security 2015-2017

Goal:	To protect the health of people by securing food quality and safety
Responsibility:	The Ministry of Industries and Innovation
Project management:	Icelandic Food and Veterinary Authority
Key stakeholders	Ministry of Industries and Innovation, Icelandic Food and Veterinary Authority, local municipal health authorities, Icelandic Food and Biotech R&D, Marine Research Institute, The Directorate of Fisheries, The Institute for Fresh Water Fisheries, The Institute for Experimental Pathology, University of Iceland – KELDUR, the Chief Epidemiologist for Iceland, and Directorate of Customs
Threats:	Natural hazards, pollution, human error, vandalism, serious livestock and plant diseases, and toxic chemical accidents.
Mitigation:	Laws and regulation, monitoring of and measures for animal and plant disease, food inspection, research and databases on environmental monitoring, monitoring primary production and food stuff, setting standards for contaminants and pollution in the environment and food.

Vulnerability:	Food import and supply, and human error
Responses:	Contingency plans for supply chain
After an event:	Verification of improvement of the environment and food stuff, and increased frequency of surveillance and research
Response system:	Contingency plans for food diseases, polluted fodder, and livestock disease
Plans for the next three years:	• Update contingency plans for food diseases and polluted fodder • Finish implementing risk assessment for public food inspection • Perform a broad spectrum risk analysis in the area of food security, with regards to among other things, stockholdings and contingency plans during a crisis. • Enhance databases

In the 2008 influenza contingency plan, there is also an analysis of what is to be done to secure the vital infrastructure (table 5).[177] This plan is currently being updated by the Chief Epidemiologist. The main task regarding food supplies in the 2008 report was securing, distributing and registration of essentials.

Table 5: Distribution of essentials (food, sanitary goods, and fuel)

Processes	Responsible party

177 Almannavarnardeild Ríkislögreglustjóra og sóttvarnarlæknir (2008) Viðbragðsáætlun vegna heimsfaraldurs inflúensu.

Listing of important essentials	Public health center
Transport of essentials between quarantined areas	Policy documents, road administration authority, carriers and sellers of essentials
Transport of essential to suppliers and shops	Carriers and suppliers
Transport of essentials from suppliers to shops	Carriers, suppliers and sellers of essentials
Suppliers and retailers	Suppliers and retailers

Delivery of essentials to households in quarantine	Retailers, road administration authorities, taxi/light good vehicles
Dissemination of education materials to the public during an influenza epidemic	Public health center in collaboration with Iceland's Business Association and the Association of Icelandic Employees
Dissemination of education materials to employees of companies about disease prevention and control	Iceland's Business Association and the Association of Icelandic Employees in collaboration with health inspectors and epidemiologists
Dissemination of information about essentials supplies to the public	Red Cross and the road administration authorities
Registering essential supplies in each quarantine areas	Sellers of essentials
Dissemination of information regarding the status of essential to the coordination centers and others quarantine areas	Sellers of essentials
Dissemination of information to quarantine areas regarding the supply status of essential supplies	Coordination center
Security in shops	Policy, security companies and rescue teams
Food packaging into proper emergency packing and send to shops.	Red Cross in collaboration with suppliers and retailers

4.4 Drinking water supplies

4.4.1 Overview

Iceland is one of the richest freshwater countries in the world with an estimate of around 600 thousand m3 per person per year and there is high availability of good quality groundwater. About 95% of the country's drinking water is untreated groundwater extracted form springs, wells, or boreholes. In Iceland the decentralized public administration plays a central in providing water services. Water utilities were established in the early first half of the 20th century by the municipalities in the most populated areas. Iceland has had 100% piped water to all its residence for decades[178].

4.4.2 Current situation

Iceland was one of the first countries to categorize drinking water as food in legislation in 1995 and one of the first countries to legislate the use of systematic preventive management to secure the safety of drinking water. Drinking water shall comply with the regulation for food in compliance with the HAACP principle or a similar management system in order to prevent contamination.

4.4.3 Upcoming trends

The largest groundwater resources are in the volcanic zones and high porosity of surface layers and bedrock characterized areas often with thin layers of soil.[179] Due to global warming, change in rainfall runoff patterns and infiltration from highland areas presently covered by glaciers may alter the groundwater and general water level.[180]

4.4.4 Structural, organizational and legislative foundation

In the central government the supply of safe drinking water falls under the jurisdiction of four ministries and their institutions:

- Ministry of Industries and Innovation and two relevant institutions: IFVA for drinking water quality and National Energy Authority (NEA) who gives permits for water abstraction
- Ministry of Environment and Natural Resources and the relevant institution: the Environment Agency (EA) responsible for water bodies

178 María J. Gunnarsdóttir (2012) Safe drinking water :Experience with Water Safety Plans and assessment of risk factors in water supply. PhD dissertation, faculty of Civil and Environmental Engineering, University of Iceland
179 María J. Gunnarsdóttir (2012) Safe drinking water :Experience with Water Safety Plans and assessment of risk factors in water supply. PhD dissertation, faculty of Civil and Environmental Engineering, University of Iceland
180 Halldór Björnsson et. al (2008) Scientific committee on climate change.

and the Planning Agency (PA) responsible for water protection in land use planning.

- Ministry of Welfare, with the Directorate of Health (DH) with regards to public health
- Ministry of Interior with responsibility to all municipal services including water supply.[181]

The responsibility of surveillance of water quality lies with the ten local Competent Authorities in the respective country. On the government level the IFVA has the role of the regulator. Regulation of drinking water is done in accordance to the Icelandic Drinking Water Regulation (IDWR) nr. 536 from 2001 and in accordance to the European Drinking Water Directive (98/83/EC). Iceland is a not a member of the EU but is a member of the European Economic Area and as such has to adapt certain parts of its national legislation to EU legislation. According to article two of IDWR, the aim of the regulation is to protect public health by ensuring that drinking water is fresh and clean.

4.4.5 Key stakeholders, partnerships and networks

The key stakeholders include Ministry of Industries and Innovation, the IFVA and NEA, Ministry of Environment and Natural Resources, EA and PA, Ministry of Welfare and DH, Ministry of Interior, water suppliers, and municipal authorities.

Current, planned and proposed measures, policies and strategies for dealing with the current drinking water supplies as well as temporary and longer term interruptions

The 2015 Policy on Civil Protection and Security lists measures for securing drinking water in times of crisis. Table 6 presents the measures of the report. Civil protection in Iceland provides guidelines for companies and individuals regarding preparedness during times of crisis. This includes a list of equipment, stocks, food, water, and medicines as well as what to do in different situations; for examples earthquakes, floods, and volcanic eruptions.[182]

Table 6: Drinking water security - Modified from the Policy on Civil Defense and Security Affairs 2015-2017

181 María J. Gunnarsdóttir 2015 – Developing a national framework for safe drinking water – Case study from Iceland – International Journal of Hygiene and Environmental Health.

182 http://www.almannavarnir.is/displayer.asp?cat_id=3

Goal:	To protect people's health by ensuring that drinking water is fresh and clean.
Responsibility:	The Ministry for the Environment and Natural Resources, the Ministry of Industries and Innovation
Project management:	The Environment Agency of Iceland
Key stakeholders:	The Ministry for the Environment and Natural Resources, the Ministry of Industries and Innovation, The Environment Agency of Iceland, Icelandic Food and Veterinary Authority, local municipal health authorities and municipal health committees, municipalities, and water suppliers, among others.
Threats:	Natural disasters, pollution, human error, vandalism, serious animal and human diseases, toxic chemical accidents.
Mitigation:	Surveillance, monitoring and research on water sources and protected areas. Instruction from the Icelandic Food and Veterinary Authority regarding drinking water sampling, quality and the treatment of surface water. Laws and regulation.
Vulnerability:	Accidental pollution incident, human error

Responses system	Contingency plans from the municipal health inspectorate regarding possible food diseases. Announcements to consumers. Regulating the distribution of water. Determining the pollution source. Monitoring and research. Activities to restore water quality
After an event:	Verification of improvement procedures, frequent monitoring, and increased research
Plans for the next three years:	• Identify demands/needs regarding the protection of water sources and carry out safety assessments of them • Create guidelines regarding drinking water which build on several different regulations • Create safety and contingency plans.

4.5 Pharmaceutical supplies

4.5.1 Overview

Historically Iceland has had a good public health care system with low infant mortality rate and ease of access, similar to the other Nordic countries. After the economic crash in 2008, due to the difficult financial situation of the Icelandic state, all public sectors had to take on austerity measures and since public health care is such a large part of the government expenses it was hit quite hard. Since 2008 there have been incidences where health establishments have complained publicly that they do not have the financial resources to fulfil their duties or buy the necessary pharmaceutical to treat patients.[183] [184] For a short period, soon after the economic crash, no financial resources were available to pay salaries or buy pharmaceutical at the National University Hospital.[185] This issue was resolved but table 7 shows that the public health care system has yet to reach the financial status that it had in 2009 at the beginning of the austerity measures. In 2015 medical equipment, medical aid,

183 http://smugan.is/2013/03/sjukrahusid-atti-ekki-peninga-fyrir-lyfinu/
184 http://eyjan.pressan.is/frettir/2015/07/21/sidferdilega-og-laeknisfraedilega-oasaettanlegt-ad-beita-ekki-nyjum-lyfjum-gegn-lifrarbolgu-c/
185 http://www.aftenposten.no/okonomi/--Valgte-a-skjule-sannheten-7140359.html

and pharmaceuticals were 12% of the government's total public health care costs.[186] The Icelandic public health care system is very sensitive to disruptions in supplies. In 2002 Iceland stopped manufacturing infusions and Iceland uses around 20 thousands units a month. The National University Hospital keeps no stock of infusion[187] in order to limit storage costs so it gets a delivery on a daily basis from the supplier. Any long term disruption of imports or a large scale accident would compromise these supplies.

Table 7 Health care costs as a percentage of GDP

Year	2008	2009	2010	2011	2012	2013	2014	2015
% of GDP	7,16	7,46	7,04	6,86	6,88	6,97	7,03	7,35

4.5.2 Current situation

Table 8 Pharmaceutical market in Iceland[188]

Manufacturer	13
Wholesalers	8
Pharmaceutical marketing agents	30
Retailers	96

Iceland is a very small market for pharmaceuticals and it is a known fact that small and medium sized markets have somewhat limited access to pharmaceutical as some of the larger pharmaceutical companies are not interested in very small markets.[189] In Iceland both the wholesale and retail

186 http://www.velferdarraduneyti.is/media/tolfraediHeilb/2015-juni-yfirlit-rekstrarutgjalda---loka.pdf
187 Mímir Arnórsson – Personal communication – Head of information sector of Icelandic Medicine Agency
188 Icelandic Medicines Agency http://www.lyfjastofnun.is/utgefid-efni/Tolfraedi/
189 Gunnarsdóttir, R., Wesenberg, G. R., Cvelbar, M

markets are in a state of oligopoly (table 8). Two retail chains control around 70% of the marketable pharmaceuticals in Iceland and two wholesalers have around 90% market share.[190] In recent years the Icelandic competition authority has fined one of the retail giants for abuse of market dominance.[191] [192]

As with food supplies, Icelandic pharmaceutical sales and production are dependent upon the imports of supplies.[193] Around 80% of pharmaceuticals are imported and it is estimated that the suppliers have on average about a month's worth of stocks at any given time. There are no direct legal obligations for pharmaceutical suppliers or producers to keep supplies in stock. Nevertheless, according to the Medicines Act No 93/1994, wholesale suppliers need to have, what is deemed appropriate by the health authorities, stocks of essential medicines which have marketing authorization and are distributed by the wholesaler.[194] What these essential medicines are is not specifically defined.

So there is no incentive for the supplier to keep more pharmaceuticals in stock since this would only increase their operation costs (e.g. for appropriate storage facilities). The pricing of pharmaceuticals in Iceland is set by a special committee with regular intervals and therefore any additional supplier costs (like keeping more stocks) cannot be transferred to the consumer directly. It is estimated that the cost for maintaining an extra month's worth of stock would cost around 1 milliard ISK for the Icelandic suppliers which is very high for suppliers in such a small market. There are also no comparable penalty clauses in Icelandic laws or regulations regarding shortage of pharmaceuticals as there are in many of the Nordic countries. For example, in some Nordic laws there are clauses regarding supply shortage stating that the supplier has to announce a shortage of supply in advance to the authorities. If they do not do that, the supplier receives a fine. There is nothing like this for Icelandic suppliers. This is another case illustrating a lack of incentive and there is no indication that this will be changed in the near future.[195] Shortages in Iceland are rare, given that transportation is functioning as normal. Rather, shortages can be attributed to the activities of the foreign primary suppliers.

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190 Mímir Arnórsson – Personal communication – Head of information sector of Icelandic Medicine Agency

191 Nr. 355/2012. http://haestirettur.is/domar?nr=8691

192http://www.samkeppni.is/media/samkeppniseftirlit/akvardanir/2010/akvordun4_2010_misnotkun_lyfja_og_heilsu_hf_a_markadsradandi_stodu_sinni.pdf

193 http://www.visindavefur.is/svar.php?id=63410

194 Mímir Arnórsson – Personal communication – Head of information sector of Icelandic Medicine Agency

195 Mímir Arnórsson – Personal communication – Head of information sector of Icelandic Medicine Agency

4.5.3 Upcoming trends

It is difficult to get a proper overview of the future trends regarding pharmaceutical supplies since data is somewhat limited on what the government intends on doing. The updated Influenza Report can perhaps shed some light on future trends but unfortunately that report is not ready yet. The Policy on Civil Protection and Security has some measures for the next three years but the longer term goals are still unclear. At the moment future trends seem unchanged, as there are no special funds allocated for increasing the pharmaceutical stocks in Iceland and there is no indication that this will change in the near future.[196]

4.5.4 Structural, organizational and legislative foundation

In Iceland there are eight stakeholders that govern pharmaceutical supplies: The Ministry of Welfare, Icelandic Medicines Agency, the Medicine Services Committee, the Directorate of Health, the Chief Epidemiologist, Iceland Health Insurance, the National University Hospital and Icelandic Radiation Safety Authority.

The legislative foundations are the Director of Health and Public Health Act, No. 41/2007, the Medicine Act No. 93 from 1994 that regulates pharmaceuticals, and Act No. 19/1997 on Health Security and Communicable Diseases where the Chief Epidemiologist for Iceland at the Directorate of Health is responsible for health security in general and public measures to prevent communicable diseases and other threats to human health.

4.5.5 Key stakeholders, partnerships and networks

Key stakeholders in the field are various Icelandic and foreign pharmaceuticals companies, the DH, the National University Hospital, Iceland Health Insurance, the Ministry of Welfare, the Icelandic Medicine Agency, patients, suppliers, doctors and the Medicine Authorization Committee.[197]

There are also cases of private - public partnership. For example, in making the Influenza contingency plan, the Icelandic authorities made an agreement with pharmaceutical giant GlaxoSmithKline that they would provide enough supplies of the Antiviral Tamiflu in case of an outbreak in Iceland.[198] The Icelandic market is dependent upon corporation of other markets and the Icelandic authorities and suppliers work closely with their colleagues in Europe, especially in the Nordic countries. After the Eyjafjallajökull eruption, which closed flight routes to Europe, the Minister of Welfare raised the issue of

196 Mímir Arnórsson – Personal communication – Head of information sector of Icelandic Medicine Agency
197 http://hhi.hi.is/sites/hhi.hi.is/files/C-Series/2007/C07_10.pdf
198 http://www.frumtok.is/media/files/CREDO.pdf

increased cooperation with the west Nordic countries regarding safeguarding pharmaceutical supplies.[199]

Current, planned and proposed measures, policies and strategies for dealing with the current pharmaceutical supplies as well as temporary and longer term interruptions

The new CDP policy and the influenza contingency plan (tables 9-10) both contain proposed measures and strategies for dealing with securing pharmaceutical supplies in times of crisis. In the 2008 influenza plan the main tasks were to: secure supplies, distribution, and registration of pharmaceutical and medical supplies. The National University Hospital has a policy in place regarding pharmaceutical stocks [200] and currently the Ministry of Welfare is working on revising the official medicine policy for 2020. In the earlier policy for 2012[201,] the issue of securing essential pharmaceutical supplies was raised and the policy report made recommendations in that regard. In the current draft of the medicine policy for 2020 the issue is hardly mentioned.[202] Iceland has a private-public partnership where suppliers work with the Icelandic Medicine Authorities to report on pharmaceutical shortage.

The Chief Epidemiologist for Iceland is currently working on revising the influenza contingency plan and the revised plan will be available at the Directorate of health. According to the Chief Epidemiologist for Iceland[203] this version will include updates in tables 3 and 5 since some of the stakeholders have changed. Unfortunately no drafts were available at the time of writing this country report (September 2015). Another plan worth mentioning is the contingency plan of The National University hospital which among other things covers the stock of vital pharmaceutical supplies[204] and the government policy on Medicine to 2020 which is currently in its final draft.[205]

199 Vestnorrænir ráðherra ræddu samstarf á sviði heilbrigðismála 15/1/2013
200 http://www.landspitali.is/lisalib/getfile.aspx?itemid=32470
201 http://www.velferdarraduneyti.is/media/Lyfjamal_-_skyrslur/Lyfjastefna_til_arsins_2012_.pdf
202 http://www.velferdarraduneyti.is/media/frettatengt2015/lokadrog-2---300715.pdf
203 Þórólfur Guðnason – Personal communication 15 september 2015
204 Viðbragðsáætlun landspítala 2014. Landspítalinn Háskóla Sjúkrahús
205 Velferðarráðuneytið (2015) Lyfjastefna til 2020.

Table 9 - The 2008 Influenza Report

Processes	Responsible party
Defining essential pharmaceuticals and disseminating information to health establishments regarding essential pharmaceuticals	the Chief Epidemiologist on the behalf of Minister of Welfare
Decision regarding the amount of antivirals in stock	The Chief Epidemiologist and the Minister of Welfare
Supervision of stocks and the distribution of medical supplies to epidemiologists	The Chief Epidemiologist, the purchasing departments of medical care establishments, the civil protection and security of the national commissioner of the police, distributers of pharmaceuticals, and postal service.
Distributing medical products in quarantined areas and making decisions regarding the timing of antiviral distribution. Reporting requirements to medical care establishments and epidemiologists.	The Chief Epidemiologist
Publication of guides regarding the use of antivirals	The Chief Epidemiologist
The preparation Tamiflu powder	The Pharmacy of the National University Hospital, pharmaceutical distributers, and the Chief Epidemiologist
Supervision of antiviral stocks in districts and distribution in quarantined areas	Epidemiologists, the chief of policy, local health establishments, and the Chief Epidemiologist
Antiviral use registration	Health care workers, epidemiologist of districts and areas and the chief epidemiologist

Table 10 Health care - Modified from the Policy on Civil Defense and Security Affairs 2015-2017

Goal:	That the health care system can respond during crises and that there are enough pharmaceutical supplies for at least six months
Responsibility:	Ministry of Welfare
Project management:	Directorate of Health
Key stakeholders:	Ministry of Welfare, Chief Epidemiologist for Iceland, Directorate for Health, health establishments, primary health care, pharmaceutical companies, municipalities, Environment Agency, Registers Iceland, Iceland Construction Authority, The National Commissioner of the Icelandic Police
Threats:	A global influenza epidemic, epidemics, natural disasters, vandalism, disturbance in the importation of pharmaceuticals and related equipment
Mitigation:	Laws on infectious diseases, cooperation, committee on disease prevention and control, vaccinations, hygiene and education, international cooperation, and active participation and monitoring by the Chief Epidemiologist for Iceland. The Chief Epidemiologist for Iceland is the link to the World Health Organization.
Vulnerability:	Influenza epidemic
Responses system	National contingency plans for a global influenza epidemic, other contingency plans for other epidemics (such as small pox), contingency plans for health establishments and institutions, plans for organizing crisis counselling, plans for toxic materials, germs and radioactive materials.
After an event:	Participants review procedures

Plans for the next three years:	• Update the national contingency plans for a global epidemic and other influenza plans. • Form and maintain contingency plans for events that threaten the public health in Iceland and worldwide. • Plans for ensuring appropriate equipment and transportation (in particular, airports and harbors) are available • Define and agree upon what are vital pharmaceutical supplies • Health inspection in airports and harbors.

Icelandic organizations

- MAST-Icelandic Food and Veterinary Authority –Matvælastofnun http://www.mast.is/english
- Matís-Icelandic Food and Biotech R&D –Matís http://www.matis.is/english/
- MRI-Marine research Institute -Hafrannsóknarstofnun http://www.hafro.is/index_eng.php
- DOF-The Directorate of Fisheries-Fiskistofa http://www.fiskistofa.is/english
- IOFF-The institute of fresh water fisheries –Veiðimálastofnun http://www.veidimal.is/default.asp?Sid_Id=22731&tId=1&Tre_Rod=002|001|&qsr
- ICG-Icelandic coast guard –Landhelgisgæslan http://www.lhg.is/english
- UST-The environment agency of Iceland –Umhverfisstofnun http://www.ust.is/the-environment-agency-of-iceland/
- ICA-Iceland Construction Authority -Mannvirkjastofnun- http://www.mannvirkjastofnun.is/english
- Keldur-The Institute For Experimental Pathology, University of Iceland, KELDUR-Tilraunastöð Háskóla Íslands í Meinafræðum að Keldum http://keldur.is/home

- CEI-The Chief Epidemiologist for Iceland-Sóttvarnarlæknir
  http://www.landlaeknir.is/english/
- DOC-Directorate of Customs-Tollstjóri
  https://www.tollur.is/English
- RI-Registers Iceland-Þjóðskrá Íslands
  https://www.skra.is/english/english/
- CDSAC-Civil Protection and Security Council-Almannavarna- og öryggismálaráð
  http://eng.forsaetisraduneyti.is/ministry/chart/
- CPDNCI-Civil Protection Department of the National Commissioner of the Icelandic Police-Almannavarnadeild Ríkislögreglustjóra
  http://www.almannavarnir.is/displayer.asp?cat_id=133
- EDC-Economic Defence Council -Hagvarnarráð-
- MOI-Ministry of the Interior-Innanríkisráðuneytið
  http://eng.innanrikisraduneyti.is/

5. Country Report – the Netherlands

Esmé Cartens

Netherlands School of Public Administration

Toon Dirkx

Marij Swinkels

CRISMART, Försvarshögskolan

5.1 Executive summary

5.1.1 General overview

In the Netherlands the security of supply chains is referred to as vital infrastructures (Vitale Infrastructuren in Dutch). The National Coordinator for Security and Terrorism (NCTV[206]), the directorate within the ministry that coordinates the security of supply chains uses a threefold approach in assessing what is vital for Dutch society to function by assessing the balancing act of vital processes in terms of 1) interests, 2) threats, and 3) resilience. When the outcomes of risk assessments show the 'triangle of interests, threats, and resilience' in balance, the process is not labeled as vital. Furthermore, the NCTV categorized vital processes to severity of impact. In this country report we have looked at four sectors, namely the sector of drinking water, food, energy and pharmaceuticals. Due to this approach taken by NCTV, the sectors of food security and pharmaceuticals are not labeled as vital to Dutch society any longer, since the triangle is stable and since both sectors reach the impact threshold in the risk assessments.

Vital infrastructures are highly prioritized in the Netherlands, the NCTV considers the security of them as one of its core tasks (NCTV annual plan, 2015), and on the list of its priorities, protecting vital sectors is ranked third.[207] During the Dutch presidency of the EU in 2016, the theme 'securitizing vital sectors' will get considerable attention in addition to the core themes cyber security and terrorism (NCTV annual plan, 2015). Furthermore, in the recent re-assessment of supply chains, the Ministry of Security and Justice changed its perspective from a 'sectoral approach' towards a 'processes approach' to pay more attention to interdependencies between the sectors. The strategy has

206 The NCTV can be considered as the Dutch counterpart of MSB, according to one of the respondents

207 First and second rank are 'dealing with jihadist threats' and 'cyber security'.

shifted from one of prevention towards one of resilience, where the government merely focuses on the impact disruptions could have and on interdependencies of vital infrastructures. Furthermore, all portfolio ministries responsible for one of the A-listed processes have laws that securitize continuous supply.

The main challenges identified for the security of vital infrastructures for the coming decade(s) are dealing with complex interdependencies, transboundary collaboration (EU, NATO), dealing with deliberate disruptions, cyber security and diverse societal needs and demands. The focus areas in the strategic approach of the Netherlands center on resilience and impact, and forming strategic alliances in public-private partnerships.

5.1.2 Food sector

The food sector is quite stable (few incidents in recent years), very self-sufficient and known for its public-private partnerships. The Netherlands is a major producer and trading partner in agricultural products, and holds a very prominent position in the international agrifoodsector: it ranges second when it comes to export, right after the United States. In total, the export of the entire agrifood sector accumulated to 80.7 billion in 2014, which means that 9 per cent of the Dutch GDP consists of the agrifood and horticulture sector. Challenges of the sector relate to ecological sustainability, public health and the robustness and resilience of the food supply chain. Scientific organizations call for a strong(er) food policy in the Netherlands, but so far nothing has been done as such on a large scale by the government.

5.1.3 Drinking water

In terms of predetermined goals and objectives, the Dutch government focuses on self-sufficiency for the drinking water sector (Tweede Kamer, 2010). Currently, the sector is highly valued and the drinking water supply companies can be labelled as excellent (Drinkwaternota, 2014: 17). The overall quality of the water is high, the costumer trust is high and drinking water costs are low. The sector has expereinced few incidents and low leakage losses, and the drinking water companies also serve as active administrators of the environment. Even though the water infrastructure is considered to be excellent, there are also some challenges for the future. Currently, the water resources differ between 1) surface, 2) soil, and 3) dune water. Water extracting processes can vary greatly, but the general quality of the drinking water is considered to be good. For now, the Dutch water sector is self-sufficient, but according to the latest policy documents of the Ministry of Infrastructure and Environment, water scarcity will increase in the years to come, creating new challenges for the supply of drinking water (Drinkwaternota, 2014).

5.1.4 Energy sector

The main priority of the vital infrastructures program is currently on energy, due to its interdependencies to other sectors and external threats. The energy sector in the Netherlands is complex, heterogeneous, changing quickly, and hotly debated in the political arena. Recent debates have focused mainly on the

uncertain outlook for oil and gas from Russia and the Middle East, oil drillings by Shell on the North Pole, earthquakes through gas extraction in Groningen province, the National Energy Accord (Nationale Energieakkoord), and the potential consequences of extracting shale gas. The sector consists of several components, namely: coal, oil, gas, renewable energy, nuclear energy, electricity and a few other sources. With 5.4 per cent, the energy sector accounts for a considerable part of the BBP of the Netherlands. The sector has been one of the key drivers of economic growth during the past century. In the upcoming years gas will lose its position as the most used source for generating energy in the Netherlands. Oil will likely take over this position in 2030 (ECN 2014: 10).

5.1.5 Pharmaceuticals

Despite criticism of the new health care system that was introduced in 2006, the Netherlands has maintained its number one position in the Euro Health Consumer Index (EHCI), which is conducted by the Health Consumer Powerhouse (HCP) [208] The HCP compares healthcare throughout Europe on the basis of: patient rights and information; accessibility; outcomes; range and reach of services provided; prevention; and pharmaceuticals. With regard to pharmaceuticals the Netherlands has the highest score of all 37 European countries included in the study.

The Minister of Health, Welfare and Sports carries a system responsibility for the healthcare system, and hence the supply chain of pharmaceuticals falls under its auspices. The consultancy firm Berenschot concluded in 2014 that even though shortages in the supply chain of pharmaceuticals have an impact on patients, this impact is generally limited to discomfort rather than serious medical consequences that can actually affect the health of the concerned patients (De Boer et al. 2014).

5.2 General overview: the Dutch 'Vital Infrastructures'

5.2.1 The Dutch security of supply chains

Security of supply chains has gained more attention since the start of the 21st century. Especially after the attacks of 9/11, the area of supply chains gained considerable attention in the Netherlands. The increasing idea of volatility of supply chains led to the program Protecting Critical Supply Chains (Bescherming Vitale Infrastructuur[209]) in 2002. Since 2004, the program became a regular policy dossier within the Ministry of Interior, leading to an annual National Security Strategy (Strategie Nationale Veiligheid) as of 2005.

208 A Swedish company founded in 2004 and owned by Johan Hjertqvist.

209 All names in both in paratheses and italics represent the official Dutch name

In 2010, when the new Rutte-cabinet assumed office, the accountability and coordination for the security of supply chains shifted to the Ministry of Security and Justice. The National Security Strategy exists of three components: the National Risk Assessment, capacity analyses, and the empirical data report National Security. In the Strategy report, short-term and long-term policy instruments are addressed, the current state of the security of supply chains, and the different sectors and sub-sectors are re-examined to check whether or not they are still vital for Dutch society. Security of supply chains is referred to as vital infrastructures (Vitale Infrastructuren). According to the definition, these entail products, services and processes that if interrupted or in shortage cause societal or economic disruptions with large-scale effects. Effects can be large in terms of the number of victims, long recuperation processes, or the lack of realistic alternatives, and consequently these are processes, services and products that the people of the Netherlands cannot be without (Tweede Kamer, 2010).

Over the years, the sectors hardly changed, leading up to twelve vital sectors and around 30 to 33 services, goods, and products that were deemed vital to Dutch society, with prioritization between sectors slightly differing. More recently however, in the 2015 re-assessment of vital infrastructures, categories were introduced to make distinctions within the vital infrastructures (see table 1). Distinctions were made in order to simplify prioritizing during incidents or to enable tailor-made solutions. Furthermore, the sectors of food and pharmaceuticals are not shown on the current list of critical supply chains (see table 2). The underlying conceptual framework of the Ministry can probably provide an answer to the question why these two sectors are no longer included. The National Coordinator for Security and Terrorism (NCTV[210]), the directorate within the ministry that coordinates security of supply chains, uses a threefold approach in assessing what is vital for Dutch society to function by assessing the balancing act of vital processes in terms of 1) interests, 2) threats, and 3) resilience.

When the outcomes of risk assessments show the 'triangle of interests, threats, and resilience' in balance, the process is not labelled as vital, which is the case now for food security (due to self-sufficiency) and pharmaceuticals (mainly due to its transboundary, European level-playing field). Furthermore, in the re-assessment of supply chains, The Ministry of Security and Justice changed its perspective from a 'sectoral approach' towards a 'processes approach' (Magazine National Security and Crisis Management, 2015) to pay more attention to interdependencies between the sectors.

[210] The NCTV can be considered as the Dutch counterpart of MSB (although its formal and judicial position does differ), according to one of the respondents

We believe that, based on our conducted policy analysis, the Dutch government has strong confidence in its crisis and response system regarding the security of supply chains. Hard work has been devoted to creating a robust and solid structure for securing supply chains. Although the policies and protocols are re-assessed continuously, the emphasis on securing supply chains from deliberate disruptions has gained considerable attention.

Table 1: Categories A and B in dealing with the security of supply chains (Source: Ministry of Security and Justice, Herijking Vitale Infrastructuren, 2015)

Category A: This category accounts for infrastructure/supply chain that when disrupted, attacked or experiences failure touches upon a minimum of at least one of the four impact criteria below:Economic consequences: > 50 billion loss or about 5% drop in relative income :
• Physical consequences: over 10,000 casualties (deaths, injuries or chronically ill) • Societal consequences: over 1 million citizens experience emotional problems or severe problems in societal security • Cascade consequences: disruption causes failure for at least two other (vital) sectors
Category B: This category accounts for infrastructure/supply chain that when disrupted, attacked or experiences failure touches upon a minimum of at least one of the three impact criteria below:
• Economic consequences: > 5 billion loss or about 1 % drop of realistic income • Physical consequences: over 1000 casualties (deaths, injuries or chronically ill) • Societal consequences: over 100,000 citizens experience emotional problems or severe problems in societal security

Table 2: Current processes (22 in total) with categorization (Source: Ministry of Security and Justice, Herijking Vitale Infrastructuren, 2015)

Processes	Category	Product, service or location	Sector	Ministry
National transport and distribution electricity	A	Electricity	Energy	Ministry of Economic Affairs
Regional transport and distribution electricity	B			
National transport and distribution gas	A	Gas		
Regional transport and distribution gas	B			
Oil supply	A	Oil		
Internet access and data; communication services; satellites	TBA end 2015		Telecom/ICT	Ministry of Economic Affairs
Drinking water supply	A	Drinking water	Drinking water	Ministry of Infrastructure & Environment
Flood defense	A	- primary flood defense system - regional flood defense system	Water	Ministry of Infrastructure & Environment
Air-traffic and	B	Mainport Schiphol and Mainport	Transport	Ministry of Infrastructure &

port-traffic		Rotterdam		Environment
Large scale production, processing, or storage of (petro) chemical material	B	(Petro)chemical industry	Chemical	Ministry of Infrastructure & Environment
Storage, production, or processing of nuclear material	B	Nuclear industry	Nuclear	Ministry of Infrastructure & Environment
Payment systems; trade transactions; cashless transactions; bank systems	B	Payment system	Financial	Ministry of Finance
Emergency management systems; national alarm number 112 and comm. system C2000; employment of police forces	B	Regulating public safety and security	Public Safety & Security	Ministry of Security & Justice
Availability of info of citizens and organizations; info-exchange; digital government systems	B	Digital government	Public Administration	Ministry of Interior & Kingdom Relations

As table 1 and 2 show, there are discrepancies between regional and national priorities in terms of categorizing the severity of incidents. In terms of legislation, the Ministry of Security and Justice is accountable for securing the vital sectors, but the Safety Regions law (Wet op de Veiligheidsregio's) requires all 28 safety regions to provide regional plans and strategies for the security of vital infrastructures in their regions (Tweede Kamer, 2015).

With regard to the organizational structure of vital infrastructures in the Netherlands, the NCTV acts as the coordinator without any formal legislation, for the responsible ministries, the safety regions (Veiligheidsregio's), as well as the private sector. They work hard to maintain the 'informal' and therefore fragile legitimacy, and mainly focus on providing the right expertise and information to the sectors. The lack of regulation and legislative foundation present both challenges as well as benefits for NCTV.

Challenges: 1) Due to a fast-changing labor market, rotation rates are high. In NCTV's work, relationship management and expertise are crucial assets, and the challenge is that they are not lost when staff members are changed. 2) Politically sensitive: when the minister changes, priorities change. The position of the NCTV is close to the political spectrum and their activities are mainly 'spot on'.

Benefits: 1) Flexibility to be able to work with the partners. 2) Continuous reporting, working collaboratively with roadmaps - maps that document the agreements between public and private organizations when one of the sectors fails to deliver. These roadmaps make it easier to implement adjustments along the way, rather than reporting to Parliament every four years (Magazine Nationale Veiligheid en Crisisbeheersing, 2015). 3) The roadmaps make it easier to finetune along the way, and make security of supply chains into a process where all three key players are equally involved. 4) Flexibility works well in a world that is becoming ever more flexible too, and makes it easier to make policy adjustments along the way.

5.2.2 Prioritization of vital infrastructures

Vital infrastructures are highly prioritized in the Netherlands. The annual budget for 2015 contains a little more than € 248 million for the NCTV in total (Rijksbegroting, 2015). The NCTV is a cluster within the Ministry of Security and Justice, and is accountable for five directorates: one of these is the Directorate of Resilience (DG Weerbaarheidsverhoging), which has the main task of coordinating the security of supply chains. In total, there is a group of people that work with vital infrastructures within NCTV (respondent NCTV), but they have little to no legal powers. Other parts of NCTV are Cyber Security, Risks and Threats, and the National Crisis Centre. The NCTV considers the security of vital sectors as one of its core tasks (NCTV annual plan, 2015), and on its list of priorities protecting vital sectors is ranked third.[211] However, the exact budget is not an easy number to calculate, since the budgets are dispersed among the responsible ministries. The responsibilities of the NCTV with regard to vital infrastructures mainly focus on coordination and soft targets. "All we do benefits vital infrastructures, but not everything is directly budgeted for them" (respondent NCTV). During the Dutch presidency of the EU in 2016, the theme

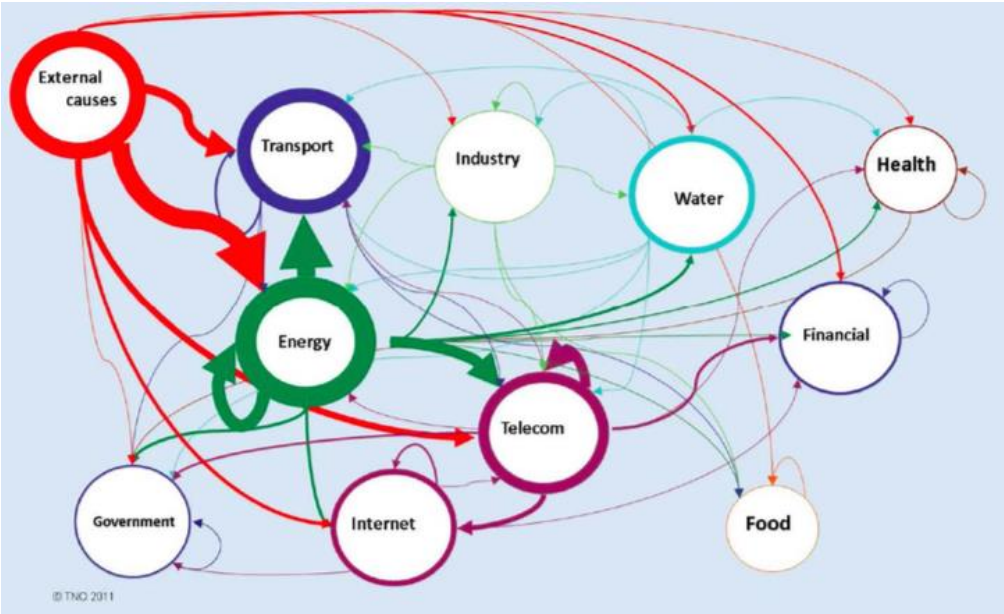
[211] First and second rank are 'dealing with jihadist threats' and 'cyber security'.

'securitizing vital sectors' will get considerable attention in addition to the core themes cyber security and terrorism (NCTV annual plan, 2015).

Furthermore, in a letter dated July 2015 from the Minister of Security and Justice proposed more intensive National Risk Assessments in regards to the issue of the National Security Strategy. The annual reports are being replaced by four annual security profiles. The security profiles will be used as a general analysis of the most important (all-hazard) risks. The risk assessments are becoming an ongoing activity, rather than annual one. This development shows that the security of supply chains has gained considerable attention over the past ten years, and is becoming increasingly prioritized (Tweede Kamer, 2015).

Differences exist between the four subjects of study here. As table 1 and 2 already showed, differences exist between the 'impact' of disruptions. Furthermore, the domains of food and pharmaceuticals are not on the radar of the NCTV in terms of vital processes any longer, since they did not touch upon the impact boundaries (see table 1) in the risk assessments. In terms of predetermined goals and objectives, the Dutch government focuses on self-sufficiency for the sectors of food and drinking water (Tweede Kamer, 2010). Disruptions in the supply chain of energy are mainly subject to geo-political diplomatic relations. Disruptions in this sector are also categorized with level 'A', meaning that disruptions tremendously affect Dutch society. Not only is the supply of energy interdependent of external factors, many of the other vital sectors are also interdependent on the energy sector. Therefore, a major priority in the program of vital infrastructures is currently on energy and telecom/ICT (see figure 1).

Figure 1: interdependencies among vital supply chains (Source: TNO, 2013)



5.2.3 Strategic foresights: The shared goal of 'continuity in society' [212]

In recent years, attention in the Dutch National Security Strategy has shifted from 'prevention' to 'resilience' and 'adaptation' (Strategie Nationale Veiligheid, 2007; TNO, 2013: 8). The existing prevention structures had become more robust over time, leading to the creation of the Directorate for Resilience. Furthermore, the focus in the different types of disruptions shifted from 'natural disruptions' to 'deliberate disruptions' (lone wolf, terrorism). Prevention and natural disruptions have not been totally eliminated from the policy dossiers, but the focus has shifted. This shift in paradigm is to the impact disruptions, rather than the threat itself (respondent NCTV). The Ministries of Security and Justice, Economic Affairs, Infrastructure and Environment, Finance, and Interior share a collaborative responsibility for securing supply chains. In the light of new threats, increasing interdependencies (such as cyber networks), changing constellations, and societal needs, they have agreed to review the current policy domain of vital infrastructures after ten years in 2012-2013. The governing board National Security (Stuurgroep Nationale Veiligheid) has already started (re)assessing various (political-administrative as well as strategic) developments regarding vital processes in Dutch society (Drinkwaternota, 2014).

The main challenges identified for the security of vital infrastructures for the coming decade(s) are dealing with complex interdependencies, transboundary collaboration (EU, NATO), dealing with deliberate disruptions, cyber security (e.g. Drinkwaternota, 2014), and diverse societal needs and demands. The focus areas in the Dutch strategic approach for securing supply chains are resilience and public-private partnerships.

5.2.4 Incident driven policies

In general, the Dutch government's policy cycles have became increasingly incident-driven over the past decade. A number of incidents have increased attention to the security of supply chains in recent years. To start with, the 9/11 attacks in New York were a major trigger for many countries to sustain the security of supply chains; the first large policy memo concerning vital infrastructures stems from the early 2000's. But not only large, international incidents triggered the increased attention of policy makers in the Netherlands, but even more local incidents; see Table 3. Nonetheless, the NCTV's strategy focuses on resilience and prevention of the unknown.

Table 3: A short list with major incidents and their consequences

[212] Realised by a collaboration of the safety regions (Veiligheidsregio's), Magazine National Security and Crisis Management, 2015

Incident	**Description**	**Consequences**
2005 Power-out Haaksbergen	25,000 inhabitants in the town Haaksbergen had to deal for 30 to 61 hours without energy.	Instigated debate. Reflected in policy documents regarding vital infrastructures
2009 H1N1 pandemic	Rapid transmission of H1N1 Influenza virus and increasing Dutch and international reactions and responses, leading to a high number of vaccines, and numerous implemented control measures.	The Ministry realized that existing crisis structures did not meet the demands of the situation and therefore, new control measures and crisis response guidelines were developed.
2011 Fire in chemical firm Chemie-Pack Moerdijk	Large chemical fire caused over 500 health complaints	Responsible ministries increased security measures, increased attention to large scale production, processing, and storage of (petro)chemical materials
2012 Earthquake Huizinge caused by gas extraction	Conflicting interests. The gas fields in the Dutch northern province of Groningen are vital for the energy supply chain. However, earthquake risks are increasing, threatening the vitality of the gas supply chain	Citizens' rights prevailed after 2013. The Dutch Safety Board concluded that the NAM (gas extraction company) and the Ministry of Economic Affairs had underestimated and neglected the potential consequences for the local inhabitants. Domestic gas supply chain under increased threat, and more dependent on external sources in the future.
2013 Incidents during the 'Russian year'	During the diplomatic year of celebrations between the Netherlands and Russia, numerous incidents took place, creating barriers between the countries (for example regarding LGBT rights).	Tensions do still exist, and grew again after the MH17 plane crash. Not much the Dutch government can do, due to its dependencies on Russia, but led to a stronger debate on energy supply.

2015 Power-out North-Holland	Due to a power outage, major consequences for a million households as well as traffic, train and bank systems.	Led to a re-assessment of ten-year policies on security of supply chains. Paradigm shift to interdependencies, digitalization, and impact on supply chain companies.

5.2.5 Best practices

To verify our findings in this report, we have discussed an earlier draft of this report with one of the two program coordinators Vital Infrastructures (*Vitale infrastructuren)* from the NCTV and discussed the Dutch best practices.

- The first best practice is the 'Alerting system of terrorism threats'. These are agreements with the private sector regarding the threat level of terrorism. When a certain threat level is reached, these businesses will take certain security measures. In return, the government exchanges valuable information with them. This is an example of public-private partnerships.
- The 'triangle' of working closely with public organizations (ministries, but also regional) and private enterprises.
- Future outlook: establishing strategic alliances and flexible networks
- Relationship management. For example working on agreements with the safety regions.
- Collaboration with industry representatives and confederations. Many of the suppliers are united in unions, which makes it easy to work with one partner that represents many (for example: Vewin for drinking water, VNO-NCW for industry and employers).

5.2.6 In short: report and future outlook

In this report we examine the security of four supply chains individually, namely the food, drinking water, energy, and pharmaceuticals. Important to keep in mind when continuing reading is that two of the four sectors, drinking water and the energy sector, are seen as vital infrastructures in the Netherlands by the Dutch government (NCTV) and thus receive additional attention in terms of research, strategies, and policies on the security of the supply chain (or the infrastructure, as the Dutch government calls it). In particular, the energy sector is one of great concern for the Dutch government due to its instable future outlook and unpredictability. Furthermore, there is a bulk of data on both sectors, and future scenarios are constantly being made which are quickly politicized.

With the other two sectors, food and pharmaceuticals, the situation is different. These sectors are no longer[213] seen as vital infrastructures since they are not perceived to be at danger in the near future. They are stable and/or self-sufficient, and therefore receive less attention in terms of their security. Securing the food supply chain has become increasingly a European matter and it is expected that other European markets would be able to help out the Netherlands in times of disruptions. The *distribution* of the food supply is still part of the vital infrastructure strategy, but is headed under the process of transport. This does not mean, however, that these sectors are not on the political agenda or are not researched. The responsible ministries and operational agencies, such as the Institute for Public Health and Environment (*Rijksinstituut voor Volksgezondheid en Milieu),* often write about trend forecasts, for example, on the website 'A healthy Netherlands'[214].

Furthermore, the Netherlands is known for its public-private partnerships, as can be seen in all sectors discussed in this report. With a long history of *polder model* (the typical Dutch consensus decision-making) and collaboration, the government have always included relevant stakeholders, even if those actors and stakeholders which are not public actors. In the latest National Security and Crisis Management magazine (*Magazine Nationale Veiligheid en Crisisbeheersing,* 2015; p.3), the head of the NCTV talks about public-private *road maps*, as aggrements on who does what and when. These *road maps* should lead to a secure and resilient infrastructure in the Netherlands and are vital for the continuity of the supply chains.

In the following parts four supply chains are discussed individually: food, drinking water, energy and pharmaceuticals.

5.3 Food

5.3.1 Overview

As of 2015, the food sector in the Netherlands is no longer considered a prioritized vital infrastructure. Hence, the supply chain is from a security-point-of-view perceived to be less prioritized than, for example, the energy sector and the water sector. There have been incidents over the past years, but none of them had such serious impacts to warrant giving the sector the weight of a 'vital infrastructure'. The sector is quite stable, very self-sufficient and known for its public-private partnerships. One example of the latter is the 'Greenports', which are networks of stakeholders) in the horticulture sector (internationally known as 'food valley' who work together to create one agenda that is supported by both the government and private actors (see below for more information).

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[213] Since the re-assesment of the vital infrastructures in 2015 by the NCTV.

[214] See for example http://www.eengezondernederland.nl/en/English_version

5.3.2 Current situation

The Netherlands is a major producer and trading partner in agricultural products. Recent figures show that the agrifoodsector is doing very well. The Netherlands holds a very prominent position in the international agrifoodsector: it ranks 2nd when it comes to export, right after the United States. The top 5 export products are[215]:

- flowers (8.1 billion annually = number 1 export country),
- meat (8 billion)
- dairy products (7.7 billion)
- vegetables (6.1 billion = number 1 export country) and
- animal and plant fats and oils (4.9 billion)

In total, the export of the entire agrifood sector accumulated to 80.7 billion in 2014, which means that 9 per cent of the GDP consists of the agrifood and horticulture sector.

5.3.3 Past incidents

Although stable and self-sufficient, the agrifoodsector has been high on the agenda due to the recent Russian boycott of Dutch food (i.e. tomatoes, cheese, flowers), low prices and an outbreak of the bird flu. Dutch farmers and agrifood entrepreneurs suffered quite severe from these developments but have, nevertheless, been able to maintain good numbers. 'The Netherlands is still a world player in the agrarian sector and is the second largest export of agrarian products in the world', Deputy-Minister Sharon Dijksma proudly noted.[216]

Nevertheless, some recent incidents have pushed the Dutch food sector to the front pages of newspapers and the forefront of political debates. One example is the European-wide horsemeat scandal of 2013 where horsemeat was sold as beef and Dutch traders played a role in the cover-up.[217] This scandal illustrated that the food supply chain has become highly concentrated and globalized and that it is very difficult to supervise the sector.

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[215] COMEXT, via http://www.rijksoverheid.nl/nieuws/2015/01/16/agrarische-export-stijgt-naar-80-7-miljard-euro.html

[216] Update by the Dutch government, via: http://www.rijksoverheid.nl/nieuws/2015/01/16/agrarische-export-stijgt-naar-80-7-miljard-euro.html

[217] For an essential guide on the horsemeat scandal, visit: http://www.theguardian.com/uk/2013/feb/15/horsemeat-scandal-the-essential-guide#104

In 2014 the Dutch Safety Board researched the meat sector and found that businesses nor the government are able to guarantee the safety of meat that is sold in the shops.[218] This resulted in the Cabinet taking additional measures to improve security and trust in the meat sector. A collaboration of the Ministry of Health, the Ministry of Economic Affairs and the industry agrred on an action plan called 'Trust in food means taking responsibility' (*Voedsel vertrouwen is verantwoordelijkheid nemen*)[219], in which they speak of *dedicated supply chains* and the industry being responsible for its own sector.

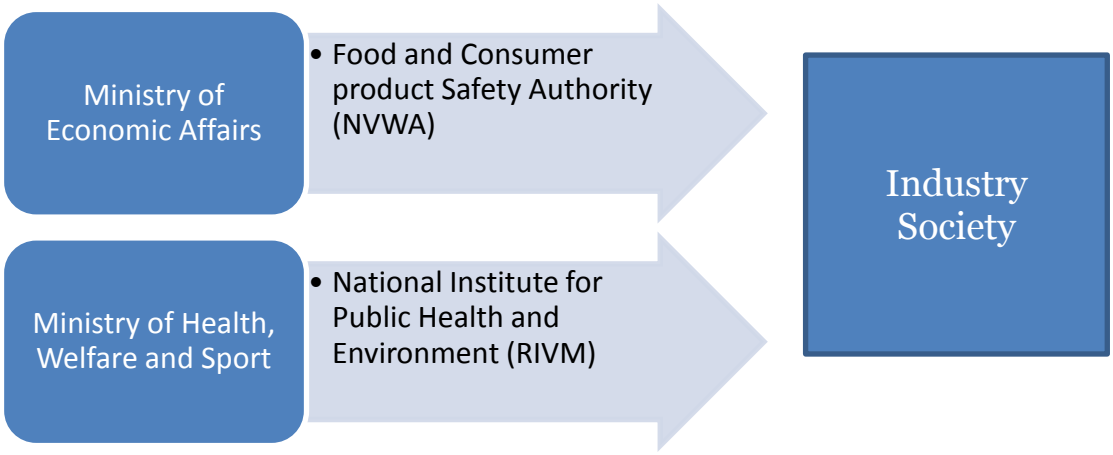
The responsibility of control and oversight was improved as well. The Netherlands Food and Consumer Product Safety Authority (*Nederlandse Voedsel en Waren Autoriteit – NvWA*), an operational agency of the Ministry of Economic Affairs, is currently training more inspectors to research the fraud within the meat sector and monitor the businesses. In this sector the NVWA now closely collaborates with the Public Prosecutors Department, (inter)national investigation agencies, border control, and the Fraud Department of the National Tax Agency (*FIOD*). Actions the NVWA can take differ from fines till closing down the companies.

5.3.4 Structural, organizational and legislative foundation

The Ministry of Health, Welfare and Sport is responsible for healthy food and food security. The Ministry of Economic Affairs holds responsibility for the agricultural sector and its resources, such as food, meat and agricultural products. Deputy-minister /State-secretary (*staatssecretaris*) Sharon Dijksma, from the Ministry of Economic Affairs, is the minister responsible for the food sector.

[218] Their report 'Risks in the meat sector' ('Risico's in de vleesketen') can be found here: http://www.rijksoverheid.nl/onderwerpen/voeding/documenten-en-publicaties/rapporten/2014/03/26/risico-s-in-de-vleesketen.html

[219] The action plan in Dutch can be found here: http://www.rijksoverheid.nl/onderwerpen/voeding/documenten-en-publicaties/rapporten/2013/06/13/actieplan-taskforce-voedselvertrouwen.html



Dutch laws for secure and safe food are the:

- Warenwet; law for all food products, but also for all consumer products such as electronics and children's toys.
- Wet dieren (animal law); which concerns food security but also health and welfare of the animals.

Furthermore, companies that make food products are obligated to have a food security plan (Hazard Analysis Critical Control Points – HACCP system)[220]. In the security plan, companies have to make a risk assessment on the security of food during food preparation and logistical operations.

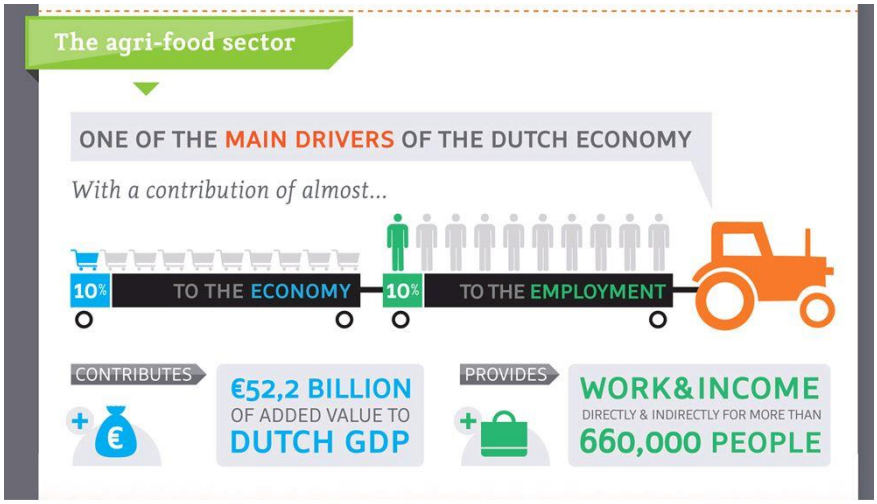
As mentioned before, control and oversight of the food sector is done by the Netherlands Food and Consumer Product Safety Authority, which has the role to protect human and animal health. It monitors food and consumer products in order to safeguard public health and animal health and welfare. The Authority monitors the production chain, from raw materials and processing to consumption. The Netherlands Food and Consumer Product Safety Authority is an independent agency in the Ministry of Economic Affairs and a delivery agency for the Ministry of Health, Welfare and Sport. On their website you can read the following: 'The three main tasks of the Netherlands Food and Consumer Product Safety Authority are: supervision, risk assessment and risk communication. Other important activities are incident and crisis management and policy advice for the Minister of Economic Affairs. A significant part of our work involves liaising with other ministries. Maintaining international contacts is also of vital importance, as was evident during the horsemeat scandal.'

[220]For more information on the different laws in this plan, visit the government website: https://www.nvwa.nl/onderwerpen/regels-voor-ondernemers-dier/dossier/haccp/regelgeving

5.3.5 Key stakeholders, partnerships and networks

The figure below gives an overview of the importance and size of the Dutch food sector for the Dutch economy.

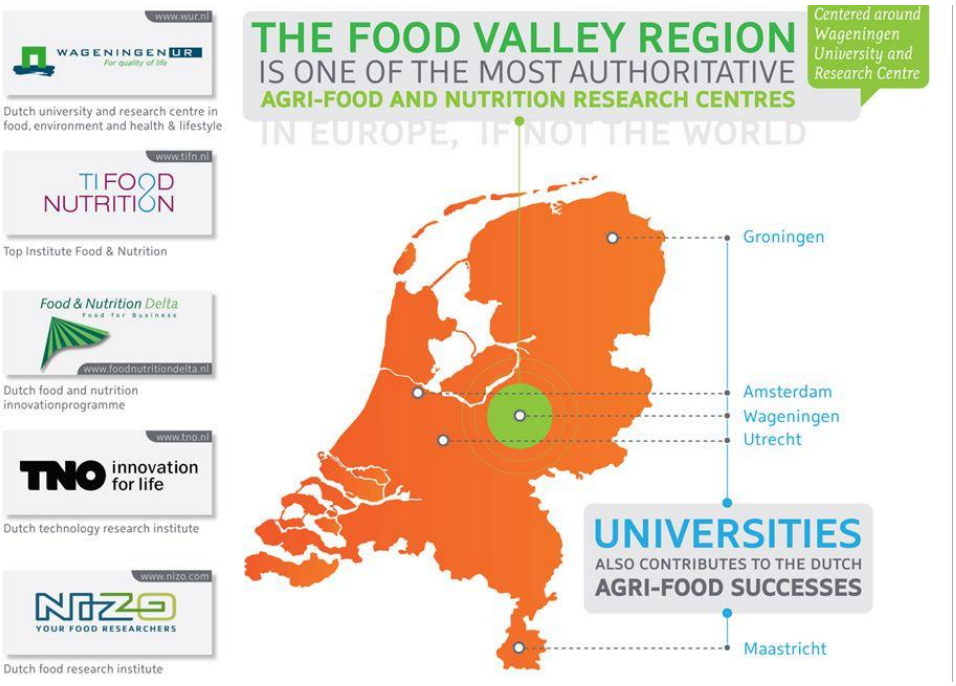
Figure 3: Economic significance of the food sector in the Netherlands



Many private companies, government authorities, universities, and research institutes collaborate and work together on issues of common concern in the so-called “food valley”; for example: TNO, Wageningen University, and the Food & Nutrition Delta. See below for a short overview.

Figure 4: Food network and research institutes in the Netherlands[221]

[221] Source: http://www.hollandtrade.com



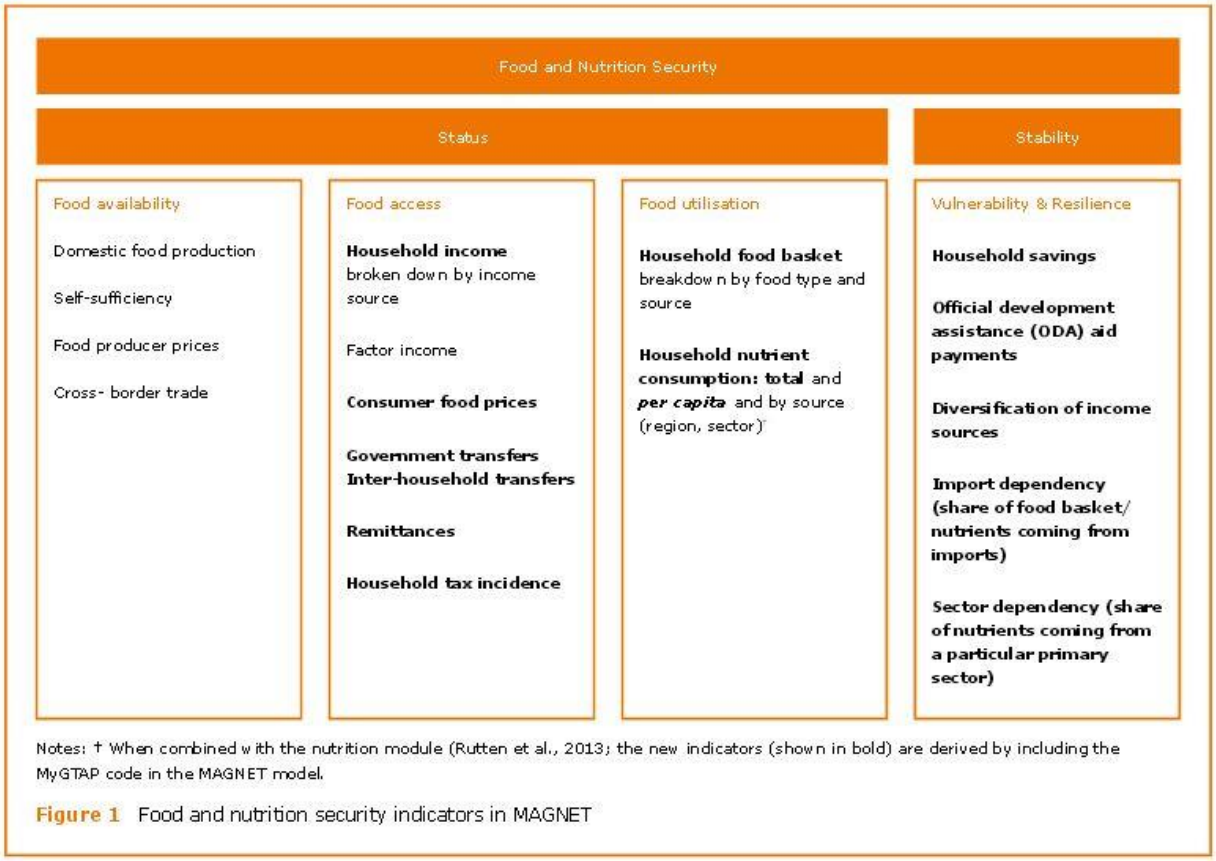
Besides major investments and the sector being of great importance for the Dutch economy, a lot of research is also done on food security and productivity at the above-mentioned research institutes. Pillars of focus in research on food and nutrition security include:[222]

1. Availability: fruit and vegetable production has increased over the past 10-15 years.
2. Income from land, labor and capital - an important determinant that influences access to fruit and vegetables.
3. Food utilization
4. Stability

As you can see in figure 5 availability depends on domestic food production, self-sufficiency, food producer prices, and cross-border trade. Although last year was a difficult year in the Netherlands (due to the Russian boycott, bird flu, and lower food prices), the Netherlands scored higher than Russia on production, self-sufficiency, and trade with other partners. The biggest importer of Dutch food and agricultural product is Germany.

[222] http://edepot.wur.nl/348737, report LEI

Figure 5: Food and nutrition security indicators ('Evaluating the impact of policy on food and nutrition security outcomes at the household level', LEI Wageningen UR)[223]



5.3.6 Vulnerabilities, threats and risks

The Scientific Council for Government Policy (*Wetenschappelijke Raad voor het Regeringsbeleid – WRR*) published an important report called 'Towards a food policy' (*Naar een voedselbeleid*[224]) in October 2014 on the current and future challenges for the agrifoodsector, from the production cycles to the consumer. The most important current and future issues cannot be seen in isolation from global developments. According to the WRR, these challenges relate to ecological sustainability, public health, and the robustness and resilience of the food supply chain. In the report *Towards a food policy*, the WRR explores the consequences of these challenges for the Netherlands and

[223] Source http://edepot.wur.nl/349631.

[224] English summary of the report can be found at the website of the WRR: http://www.wrr.nl/fileadmin/en/publicaties/PDF-samenvattingen/Synopsis_WRR-report_93_Towards_a_Food_Policy.pdf

the risks and opportunities they create for the Dutch government and Dutch society.

According to the WRR the following should be done: 'It is time for an explicit food policy; a policy that takes into account the diversity of values in relation to food, the relationship between production and consumption and the changing power relations in the food system. In this report, the Council also highlights the need to invest in the resilience of the food system' (WRR press release, 2014).

5.3.7 Current, planned and proposed measures, policies and strategies for dealing with the current food supplies as well as temporary and longer term interruptions

The Dutch government is required to react to every report published by the WRR, but at the time of writing this report (August 2015) unfortunately they not commented on the *Towards a food policy* report yet. Deputy Minister Sharon Dijksma first wrote to the Parliament that she would reply in January 2015. Then on 3 February 2015 she wrote the Parliament once more and stated that her reply would be submitted in the spring 2015. Mid-may she wrote another letter that her reply would be submitted around the political recess of the summer holiday. Still there has not been a reaction. In our opinion this is mainly because the food sector is vital, but balanced. There are no main security struggles and therefore it is a lower priority. This is also backed by the Food and Agricultural Organization of the United Nations: 'food markets are becoming more balanced and less volatile in recent years' (FAO 2013).

So although many challenges lie ahead for the Dutch food sector, according to the Scientific Council, the food sector was not on the 2015 list of vital infrastructures. According to our respondent, this is because it is an healthy sector, with relatively few incidents, it is very self-sufficient and the risk perspective is low (in their words, the relation between resilience, threats and interests is balanced). Below some themes that will be of focus for the next few years.

Figure 6: Focus themes for the food sector[225]

[225] Source: www.hollandtrade.com

5.4 Drinking water

5.4.1 Overview – current situation and upcoming trends

In the Netherlands, there are about 500 water purification plants that are maintained by ten drinking water companies. The ten suppliers staff over 5000 people that work on maintaining high quality drinking water each year.[226] Together, the companies produce 1.126 m3 of water and transport the water over a length of 119,000 km. The majority of material used for the transport of water is PVC, but for 35,000 km asbestos cement is still in use, which if broken can cause threats to the quality of the water. The total number of households registered on the net of water supply is 7,973,000. Together, the Dutch people pay 258 million of water taxes, and a total of 431 million is invested in drinking water management (Vewin, 2013). The Dutch water sector is self-sufficient for now, but according to the latest policy documents of the Ministry of Infrastructure and Environment, water scarcity will increase in the upcoming years, creating new challenges for the supply of drinking water (Drinkwaternota, 2014).

Currently, the Dutch drinking water sector is a highly valued sector, and the drinking water supply companies can be labeled as excellent (Drinkwaternota, 2014: 17). The overall quality of the water is high, costumer trust is high, and the general cost of drinking water is low. The sector knows little to no incidents and has low leakage losses. In addition, the drinking water companies also serve as active administrators of the environment.

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[226] Companies and FTE: Brabant Water 754, Evides 690, Vitens 1400, WML 399, Dunea 517, Oasen 263, WMD, 154, Waterbedrijf Groningen, 224, PWN, 523, Waternet [unknown]

Furthermore, the network of water infrastructure is considered to be very good, but provides some challenges for the future. Currently, the water resources differ between 1) surface, 2) soil, or 3) dune water. The processes of extracting water can be very different and have not been taken into account here, but the general quality of the drinking water is considered to be good. The quality of the drinking water resources is however being put under increased pressure due to numerous threats to the soil (like chemical usage in bio-industry), climate change, the increased usage of pharmaceuticals and cosmetics, and the usage of chloride and nitrates that can potentially harm water and soil quality. The first future challenge for the water sector is making sure that there are enough basins. Other challenges for the future are continuous innovations in more efficient water usage and increasing pressure to keep investing in the infrastructure and water network.

Although the sector has witnessed few incidents, an example of the increasing threats was illustrated in the summer of 2015, when levels of pyrazoles (byproduct of chemicals used for pharmaceuticals) increased in the surface water of the Maas river, leading to a stop in purification from the river water.

The service most needed to maintain the security of the supply and access to drinking water are the supply plans provided by the drinking water companies. In these supply plans, every drinking water company (ten in total) is responsible for a certain area and submits a supply plan to the Human Environment and Transport Inspectorate. The inspectorate assesses the viability of the plans and tests them to a variety of scenarios. If the plans 'pass' the viability test, the drinking water company is deemed knowledgeable in providing secure and quality drinking water, even in times of emergencies.

5.4.2 Structural, organizational and legislative foundation

The Ministry of Infrastructure and Environment has the main responsibility for the sector. They have a so-called system responsibility. The main responsibility for securing the supply chain, taking care of high quality drinking water, and ensuring emergency water reserves however is delegated to the drinking water companies. They are the first to be held accountable for addressing issues related to drinking water supplies. The drinking water companies are so called corporate organizations with a public interest. Due to the fact that water is a basic human need, the Dutch government decided that these companies could not be completely privatized. Therefore provinces and municipalities are the shareholders/stakeholders of the drinking water suppliers in their regions, creating a sort of public-private corporation. As stakeholders, the provinces and municipalities have no influence on the daily business of the companies, but they have executive powers in setting tariffs, business plans, and investments as well as in appointing commissioners and the board of directors. The companies are therefore accountable to the public stakeholders, and via this structure the public stakeholders are in turn accountable to the citizens (Drinkwaternota, 2014: 25). Together with the 28 safety regions and the police force, the drinking water companies have signed agreements regarding

collaboration during incidents or crises that affect the water supply (Vewin, 2010).

Roles and mandates seem theoretically clear. Responsibility is decentralized, but system responsibility is vested with the Ministry of Infrastructure and Environment as the national safeguard. Combined, the sector has prioritized seven shared goals up until 2040:

1. Enough water that has the good quality now and in the future (to 2040)
2. Monitoring drinking water quality through risk assessments and innovations
3. Maintain the good condition of drinking water infrastructure
4. Increasing resilience of vital drinking water infrastructure (supply chain security)
5. Maintaining consumer trust
6. Access to drinking water
7. Strengthening international position of drinking water suppliers

There is a number of relevant legislation regarding security of drinking water. Firstly, there is the EU drinking water directive (98/83/EG), which provides an important legal foundation for the Drinkwaterwet (Drinking water law). It requires the Netherlands to list quality demands for drinking water, make sure that the quality of the water is monitored, and prepare for suitable measures for when the quality demands are ignored. The Netherlands is on top with regard to the implications of the EU directive. Secondly, the implementation of the EU directive in the Netherlands led to the Drinkwaterwet in 2011 (which replaced the Waterleidingwet from 1995).

Legislative foundations for protecting drinking water resources from this Drinkwaterwet are: making sure there is enough water, following a solid prevention and escalation ladder, addressing strategic stocks and supplies for crises, creating national reserves, maintaining quality, and respecting the law.

Important notions imposed by this law are:

- Statutory responsibility of governing bodies for secure drinking water resources.

- Drinking water as key public interest, and a basic human right[227]. The law defines public drinking water resources as "a vital public service with large public interest"[228]. The role of the national government is conditional and procedural[229]. The current strategic focus (based on risk assessments) on the national level now will be cyber security and flooding (Drinkwaternota, 2014: 9).
- Governing bodies are responsible for securing public access to drinking water. It is of critical importance for the public service that they live up to this responsibility. They are accountable to provide good quality drinking water to their consumers.
- Improving quality of resources (focus on prevention)
- Maintain quality of drinking waterNational security and supply security: vital drinking water interests have to be protected from 'source to tap' in order to limit societal disruptions. The base line is that the sector itself is responsible for the security and continuity of the drinking water supply. During disruptions of the public drinking water supply, drinking water companies are legally responsible to supply emergency reserves (as stated in article 35, Drinkwaterwet) (Drinkwaternota, 2014: 30).
- Investing in water infrastructure
- Minimizing the effects on the environment

In addition to the EU directive and the Drinkwaterwet, other relevant legislation includes:

- Framework Water (KaderRichtlijn Water)/ European framework: European regulation that requires member states to address locations where water is being obtained for human consumption. Member states bear the responsibility to protect the water infrastructure and the quality of the water.
- Environment law (Wet Mileubeheer): which bounds provinces to address areas for protected soil water reserves.

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[227] According to the Dutch constitution, the government takes measures to improve public health (article 22, lid 1). Drinking water is a life necessity and the quality of drinking water has tremendous effects on public health.

[228] Nieuwe bepalingen met betrekking tot de productie en distributie van drinkwater en de organisatie van de openbare drinkwatervoorziening (Drinkwaterwet) – Memorie van Toelichting. Tweede Kamer, Vergaderjaar 2006-2007, Kamerstuk 30 895 nr. 3

[229] Tweede Kamer, 2006-2007, 30 895, nr. 3: 5

- Furthermore, the aforementioned signed agreements are in place during incidents or crises.

5.4.3 Key stakeholders, partnerships and networks

In the figure above, the main stakeholders in the Dutch water sector and security of the supply chain are presented. Relevant partnerships mainly exist in the 'export' of water knowledge. The Dutch reputation in the field of drinking water supply is extremely high in countries outside the Netherlands. This is partly reflected in the Netherlands' role as frontrunner in Europe. Secondly, the Netherlands is home base of world-leading water education institute UNESCO-IHE, ownership of all UN/UNESCO member states. For the Dutch Minister of Trade and Development Cooperation (without portfolio), development cooperation in water management is high on the agenda.

Within the Netherlands, community or private initiatives are rare, but nonetheless existing. Many of the initiatives focus on water sustainability: reducing the amount of water usage, or recycling water. Larger companies, such as Schiphol airport, invest in sustainable water recycling solutions as part of corporate social responsibility. Recently, four large companies, among them Coca-Cola Netherlands and Fujifilm, closed a deal with *New Waterbusiness* to start a private and sustainable purification plant on the grounds of Fujifilm. This will be the first large-scale purification plant in the hands of corporate enterprises in the Netherlands (Staatscourant, 2015). This is interesting on the one hand because the companies invest in sustainable water recycling. At the same time, it poses challenges for those in charge of securing drinking water

supply and quality for citizens, since the State is no longer owner of the purification plant.

Citizens themselves are required to prepare for crisis situations, with government campaigns launched on television and the internet.[230] One of the more known campaigns is the 'Be prepared'[231] campaign, where the Dutch government encourages its citizens to compose a 'emergency pack' for crisis or disaster situations. In this emergency kit, there should be enough drinking water available.

5.4.4 Current, planned and proposed measures, policies and strategies for dealing with the current drinking water supplies as well as temporary and longer term interruptions

The country's overriding strategy and priorities for the security of drinking water supplies are focused on resilience, uniformity in supply chain plans of the drinking water companies, and making sure that dispersed accountability among drinking water suppliers is assumed and acted upon.

Specifically, in the current Drinkwaternota (2014), the sub-goals to invest in securing the supply chain:

- Integrated analysis of the protection of critical drinking water infrastructure
- Increasing resilience during drinking water crisis by trying to minimize risks in supply chain plans
- Securing the availability of emergency response drinking water in case of calamities
- Directing and protecting national soil water reserves with regard to the national security

5.4.5 Vulnerabilities, threats and risks

The 2014/2015 re-assessment of the vital sectors identified drinking water supply as a vital process for the continuation of Dutch society, categorized as A-priority (see also part 1, general overview, for an explanation on the categorizations). For continuous quality and supply of drinking water, the RIVM analyzes the supply plans. The idea is to create uniformity in supply plans and to prepare for disruptions (a variety of 25 scenarios are considered). Disruptions that create national and economic damage and societal unrest (as cyber security breaches or floodings) get special attention in the assessment.

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[230] www.crisis.nl

[231] http://www.crisis.nl/wees-voorbereid/noodpakketten.aspx

The supply plans have to be reviewed after submission by the Human Environment and Transport Inspectorate.

In recent years, deliberate disruptions have become an issue gaining more attention as a relatively new but growing threat, according to the risk assessments. Deliberate disruptions are mainly framed as 'cyber security' disruptions. The Ministry of Infrastructure and Environment puts effort into evaluating which processes, criteria and risks concerning cyber security in water management can be identified. Other issues concerning the national security include: flood preparation (collaboration with Delta program), agreements on deployment of emergency reserves, appointing and protecting soil and water reserves (STRONG program; *structuurvisie ondergrond*), and stated interest in calamities plans (RIVM concluded that not all safety regions and stakeholders include water supply chains in their calamities plans).[232]

5.4.6 International collaboration

As stated before, collaboration with the EU and compliance to EU regulation are high. As for the UN, the Dutch government participates in many development projects concerning water management, based on the long-standing expertise of the Dutch in water management. Furthermore, as mentioned, UNESCO-IHE provides international training in Delft, where people from all over the world gather to learn about access to and quality of drinking water.

5.5 Energy

5.5.1 Overview – current situation and upcoming trends

The energy sector in the Netherlands is complex, heterogeneous, and changing rapidly. Energy policies are high on the political agenda. Recent debates have focused mostly on the uncertainty about oil and gas from Russia and the Middle East, oil drillings by Shell in the north pole, earthquakes near gas extraction in Groningen province, the National Energy Accord (Nationale Energieakkoord),[233] and the potential consequences of extracting shale gas. Furthermore, a power outage in North-Holland province in March 2015

[232] http://www.helpdeskwater.nl/onderwerpen/wetgeving-beleid/handboek-water-0/thema'/watertekort/verdringingsreeks/

[233] In September 2013, forty organisations, consisting of the government, employers, trade unions, environmental organizations, other civil society organisations and financial institutions backed the National Energy Accord about sustainable growth. The core of the accord are agreements about energy reduction, clean technologies and climate policy, which will have to lead to an affordable and clean energy sector, job opportunities and business opportunities in clean technology markets (SER 2013). For more information see: http://www.energieakkoordser.nl/energieakkoord.aspx

showed the far-reaching consequences of a disruption in one of the most vital infrastructures of the country. Making choices within this field of interconnected energy policies is not easy due to a complex spectrum of interests that are at stake and external threats that can cause disruptions in the security of the supply chain. The political answers to the challenges of the future of the energy sector will not be discussed in this chapter, but it is important to keep in mind that this sector is the most politicized sector of all sectors that are investigated in this report.

The energy sector in the Netherlands consists of several components, namely:

- Coal
- Oil
- Gas
- Renewable energy
- Nuclear energy
- Energy from other sources
- Electricity

The table below provided by 'Statistics Netherlands' (www.cbs.nl) shows the key figures in the Dutch energy sector, including the energy supply, energy transformation and energy consumption.

Subjects	Energy commodities	Periods	2014*								
		Total energy commodities	Total coal and coal products	Total crude and petroleum products	Natural gas	Renewable energy	Nuclear energy	Energy from other sources	Electricity	Heat
Energy supply	Total Primary Energy Supply (TPES)	PJ	3 036	379	1 180	1 208	133	39	43	53	-
	Indigenous production		2 403	-	95	2 101	131	39	37	-	-
	Imports		10 505	1 454	8 037	874	14	-	7	118	-
	Exports		9 109	1 040	6 227	1 763	13	-	1	65	-
	Net imports		1 396	414	1 811	-889	1	-	6	53	-
	Bunkers		692	-	692	0	-	-	-	-	-
	Stock change		-70	-34	-33	-3	-	-	-	-	-
Energy transformation	Electricity and CHP transformation input		957	283	26	439	97	39	36	17	19
	Other transformation input		3 450	187	3 210	32	18	-	2	1	1
	Electricity/CHP transformation output		565	-	-	-	-	-	-	372	193
	Other transformation output		3 323	113	3 183	7	-	-	-	-	19
Energy consumption	Total energy consumption		3 042	379	1 185	1 208	133	39	43	54	0
	Net electricity/CHP transformation		392	283	26	439	97	39	36	-356	-174
	Net other transformation		127	74	27	24	18	-	2	1	-19
	Final energy consumption		1 773	20	570	618	17	-	6	370	171
	Non-energy use		566	2	482	83	-	-	-	-	-

With 5.4 per cent, the energy sector accounts for a large part of the BBP of the Netherlands. The sector has been one of the key drivers of economic growth during the past century. Specific characteristics of the Dutch energy sector that set it apart from neighboring countries are:

- A gas field in the northern part of the country that has been generating a large portion of the domestic gas supply since the 1950s.
- The Royal Dutch Shell is one of the largest private enterprises in the world, and the most profitable company in the Netherlands. It is one of the key players in the international energy market.
- The port of Rotterdam serves as a gateway to the rest of Europe for many different goods, including oil, gas and coal.

In the upcoming years gas will lose its position as the most used energy source in the Netherlands. The gas consumption is declining and this is likely to continue in the next decade due to a depletion of the available gas. The coal consumption is expected to increase dramatically in the short term, but will decline in the years thereafter. The use of renewable energy will increase. The demand for oil will increase in industry, and even though this demand will diminish in the traffic and transport sector, the total demand for oil will remain relatively consistent. As such, oil will likely take over the position of most used energy source in the Netherlands in 2030 (ECN 2014: 10).

The energy sector (electricity, gas, oil, nuclear) are considered a vital infrastructure of category A.[234] As in the rest of Western Europe, the Netherlands is taking steps to reduce its carbon intensive economy, and renewable energy is high on the political agenda but it is not explicitly mentioned in the vital infrastructures as a separate sector. It seems to be interwoven with the “old sources” of energy (electricity, gas, oil and nuclear). A disruption in renewable energy would hence not be seen as a disruption that could damage the energy sector entirely.

The components of the energy sector that are dealt with by the Ministry of Economic Affairs are electricity, gas and oil. The Ministry of Infrastructure and the Environment deals with nuclear energy. These four components, which are regarded as vital for the energy sector as a whole, are briefly discussed below.

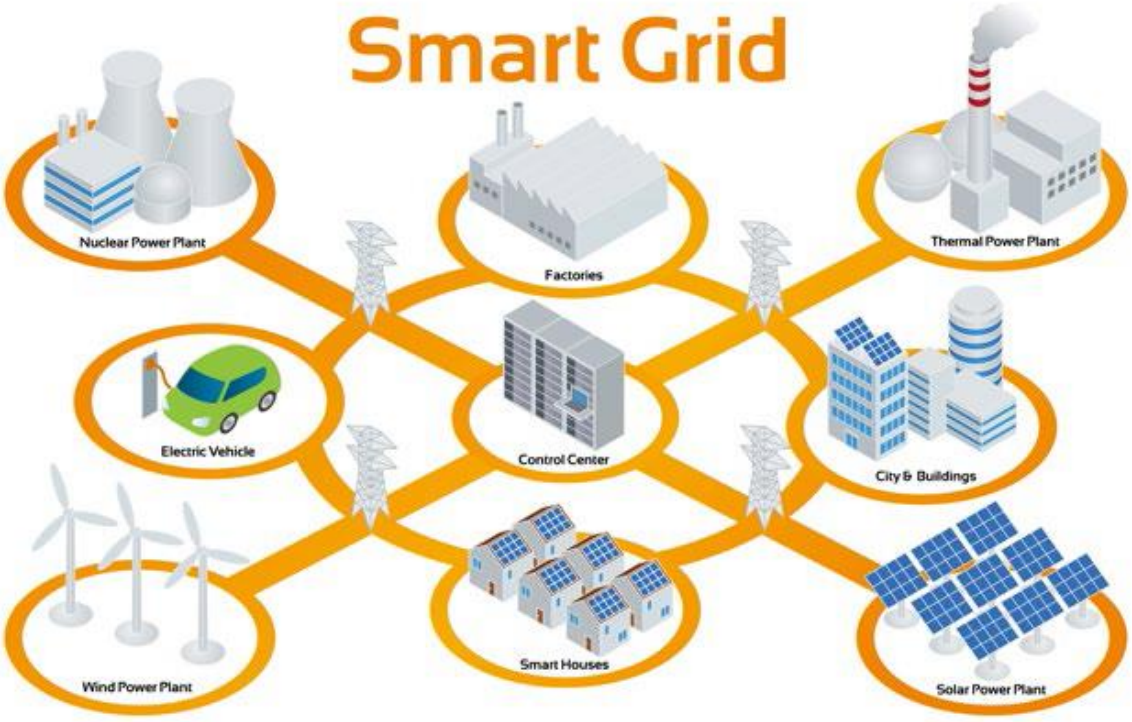
5.5.2 Electricity

Electricity is one of the most important components of the vital infrastructures in general. Sectors such as transport, finance and drinking water are highly dependent on electricity. Together with a tendency to replace other energy sources with electricity and an increase of various sustainable sources this leads

[234] See table 1 and 2 chapter 1 for a complete overview of all the vital infrastructures.

to a so-called “double risk trend”. As such there is increasing uncertainty whether the Dutch electricity grid will be able to deliver reliable electric in the appropriate quantities at the right time and place (Vaessen 2015: 8).

In response to the changes in the electricity sector, the Netherlands is focusing on a hybrid electricity net, which consists of a combination of different technologies like direct and alternating current, conventional and sustainable power generation, and large and small scale. Such a network is both robust and flexible, and is able to provide affordable, reliable and sustainable electricity for users in the future. This electricity network is envisioned to be a so-called “Smart Grid” (Vaessen 2015: 8).



5.5.3 Oil

As stated, the Royal Dutch Shell is the most profitable company in the Netherlands. Vitol is less known, but also accounts for 230 billion euros in revenues. The port of Rotterdam has 13.6 million cubic meters of storage capacity for crude oil and processed oil products (van der Linde 2015: 12). In Rotterdam there are five oil refineries with a capacity to distillate 58 million tons of oil.

5.5.4 Gas

The gas as an energy source is also highly dependent on electricity and vice versa. (Fennema 2015; 10). Since the 1960s the Gas Union (Gasunie)[235], which is 100 percent owned by the Dutch State, has extracted gas from a gas field in Groningen Province (in the northern part of the Netherlands). The figure below shows how the gas network is set up, with Groningen as its epicentre:

5.5.5 Nuclear energy

The Netherlands has one operating nuclear power plant in Borsele which is owned by EPZ[236]. The plant started working in 1973 and is scheduled to close in 2033 at the latest. This was agreed upon by EPZ and the Dutch government. The nuclear power plant in Borsele accounts for about 4 percent of the total consumption of electricity in the Netherlands. There used to be another

[235] See http://www.gasunie.nl/en/about-gasunie

[236] EPZ is a joint venture of DELTA and Energy Resources Holding BV, which is part of the German energy company RWE.

operating nuclear power plant in Dodewaard, but it was closed in 1997 and will remain in a state of safe enclosure until 2045 when the plant will be dismantled.

5.5.6 Structural, organizational and legislative foundation

As with all other supply chains discussed, the scale of a disruption determines whether the crisis will be dealt with on a local, regional or national level. Local or regional crises are most of the times dealt with by regional government bodies such as municipalities and/or the safety regions (veiligheidsregio's). For a national crisis the Minister of Security and Justice has a coordinating role, but each ministry has its own coordination center. In the case of a disruption in the energy supply chain, the Ministry of Economic Affairs for electricity is responsible for gas and oil, and the Ministry of Infrastructure and the Environment is responsible for nuclear energy. In the event of a nuclear crisis, there is a National Crisis Plan for Radiation Incidents (Nationaal Crisisplan Stralingsincidenten); a joint effort between the Ministry of Infrastructure and the Environment and the Ministry of Economic Affairs.

There are both EU regulations and Dutch legislation in place governing the energy sector. The Dutch legislation consists of:

- the electricity law 1998;
- the gas law;
- the heating law;
- the law regarding the implementation of EU guidelines on energy efficiency;
- the law of 12 July 2012 to alter the electricity law 1998 and the gas law;
- the law of 23 November 2006 to alter the electricity law 1998 and the gas law due to rules regarding an independent network operator.

In the Netherlands, the Authority Consumer and Market (ACM) supervises the implementation of rules and legislation with regard to energy.

5.5.7 Key stakeholders, partnerships and networks

The energy sector in the Netherlands consists of energy producers and suppliers, producers of equipment (e.g. solar energy), construction and installation industry, consultancy firms, IT companies specialised in energy systems, research institutes, and governmental bodies (Jaarbericht Sectoren 2015).

The Netherlands participates in several energy networks and is connected to for example oil refineries in Belgium and Germany. Oil refineries in Rotterdam are part of the Central European Pipeline System (CEPS) of NATO, which connects the refineries with military and commercial airports.

In recent years, alongside the trend of renewable energy, numerous sustainable energy projects have started. The Dutch government has allocated subsidies to people who bought solar panels in 2012 and 2013. As of 2015 there are no such subsidies anymore, but there are still some tax benefits for sustainable energy projects.

In case of a major power outage, private individuals are expected to listen to a battery-operated radio for instructions and requested not to call the 112 emergency telephone number unless there is a direct emergency or threat. These types of instructions are communicated through various channels, for example, brochures and the following link: crisis.nl/wees-voorbereid/stroomuitval. This web site is run by the NCTV.

5.5.8 Current, planned and proposed measures, policies and strategies for dealing with the current energy supplies as well as temporary and longer term interruptions

The strategy of the Dutch government with regard to the security of energy supplies focuses largely on raw materials and energy abroad on which the Dutch economy is dependent. The strong economic position of the Netherlands is predominantly based on access to these raw materials in foreign countries. Therefore, the Dutch government emphasizes the importance of a level playing field for Dutch companies, unhampered international trade according to transparent rules, and free trade routes. This relates to the strategic security interests of the Netherlands to secure trade routes and access to raw materials. The rules of the global economic system should be strengthened, respected and enforced according the Dutch government. Global economic chains must be protected against piracy, cyber attacks, espionage, fraud, corruption and all forms of organized crime (Veilige Wereld, Veilig Nederland 2013: 10).

Conflicts abroad can harm the energy sector and the wider Dutch economy. Threats, for example, to trade routes are not only a risk for the Dutch energy sector, but can also affect the Dutch position as a transit country to the European hinterland, especially the role of Rotterdam as a transit port. As such the Dutch energy sector is dependent on many factors on which the Dutch government has little or no influence. Hence, dependency on fossil fuels increases the vulnerability of the supply chain (Veilige Wereld, Veilig Nederland 2013: 11).

Policy tools that are used to mitigate these threats include working together with the private sector, using economic diplomacy, and supporting good governance projects in regions with unstable states (e.g. the Middle East, North Africa and the Sahel). It is primarily up to the private sector to ensure access to raw materials, but the government may have an additional role when problems arise (Veilige Wereld, Veilig Nederland 2013: 19). The Minister of Economic Affairs, Henk Kamp, recently stated that he wants to explore the possibilities to extract gas from the North Sea in order to become less dependent on foreign gas in the future.

5.5.9 International collaboration

Since the Netherlands is to a large extent dependent on sources of energy in foreign countries, continuous efforts are undertaken by the Dutch government to secure energy interests through multilateral fora such as the EU, NATO and the UN (Veilige Wereld, Veilig Nederland 2013).

5.6 Pharmaceuticals

5.6.1 Overview – current situation and upcoming trends

Pharmaceutical supplies in the Netherlands are not part of the vital infrastructures. Hence, the supply chain is from a security-point-of-view perceived to be less important than for example the energy sector and the water sector. Nevertheless, the topic of pharmaceutical supplies and especially the wider Dutch healthcare system are heavily debated in the national arena. As a consequence of the 'baby boom' in the Netherlands from 1945 until 1965, a large part of the Dutch working force has recently retired or will do so in the near future. The growing percentage of elderly people in the country has induced public debates about the affordability of the welfare state and the healthcare system.

An important development in recent years was the change to a privatized healthcare system in 2006. The biggest change is that all citizens are now required to purchase health insurance from a private insurance company. Depending on the income of an individual/family an allowance is provided by the government to pay for some of the health insurance costs. As such, insurers have become more important in the healthcare system. However, contrary to many other countries, healthcare premiums may not be related to status, health, or age. It is mandatory for insurance companies to offer a universal package and it is illegal to impose special conditions for certain individuals. By doing so, the Dutch government has remained responsible for the quality and accessibility of the system, but it is no longer in charge of its management. Despite criticisms on the new healthcare system, the Netherlands has maintained its number one position in the Euro health consumer index (EHCI), conducted by the Health Consumer Powerhouse (HCP). The HCP collects and compares information about healthcare throughout Europe including: patient rights and information; accessibility; outcomes; range and reach of services provided; prevention; and pharmaceuticals. With regard to pharmaceuticals the Netherlands has the highest score of all 37 European countries participating in the study.

The Minister of Health, Welfare and Sports carries a system responsibility for the healthcare system, and hence the supply chain of pharmaceuticals falls under its auspices. In recent years various members of parliament have asked questions to the minister about shortages in the supply chain of certain medicines, but even though there are occasional incidents no major problems have occurred. The consultancy firm Berenschot concluded in 2014 that even though shortages in the supply chain of pharmaceuticals have an impact on

patients, this impact is generally limited to discomfort rather than serious medical consequences that can actually affect the health of the concerned patients. Healthcare providers are making efforts to resolve shortages in the pharmaceutical supply chain and ensure that the impact to patients is limited in most cases (De Boer et al. 2014).

5.6.2 Structural, organizational and legislative foundation

There are many organizations and companies involved in the supply chain of pharmaceuticals. An important organization in this regard is KNMP Farmanco, which was established by the Laboratory of Dutch Pharamacists (Laboratorium Nederlandse Apothekers - LNA) to improve the healthcare system by providing essential medicines. Whenever problems arise with the availability of medicines, these can be reported to KNMP Farmanco. The organization keeps records of these incidents and provides information about the reason of non-availability, the expected date of availability, pharmaceutical substitution, and pharmacotheratpeutic alternatives.

A more recent development is the establishment of the 'Working Group Medicine Shortages' (Werkgroep geneesmiddelentekorten), whose task it is to develop a new notification and registration system. This working group has been established after concerns about the availability of medicines and the security of the supply chain of pharmaceuticals.

The Medicines Evaluation Board (College ter Beoordeling van Geneesmiddelen) assesses and monitors the efficacy, risks and quality of human and veterinary medicines, and the safety of novel foods for human consumption. The MEB independently decides about the authorization and monitoring of human medicinal products.

Other organizations who are involved in the supply chain of pharmaceuticals are several associations of pharmacists in the Netherlands. These are:

- Koninklijke Nederlandse Maatschappij ter bevordering der Pharmacie (KNMP)
- Nederlandse Vereniging van Ziekenhuisapothekers (NVZA)
- Vereniging van Nederlandse Industrie-Apothekers (NIA)
- Vereniging van Apothekers in opleiding tot Ziekenhuisapotheker (VAZA)
- Vereniging van Jonge Apothekers (VJA)

Healthcare in the Netherlands is covered by two laws about healthcare insurance:

- Basic health insurance act (Zorgverzekeringswet - Zvw). It covers common medical care;

- Exceptional Medical Expenses act (Algemene Wet Bijzondere Ziektekosten - AWBZ). It covers long-term nursing and care.

According to Berenschot (2014), there are no financial consequences for patients when there is a shortage in certain medicines. The price difference is mostly paid for by either pharmacists or health insurers.

5.6.3 Key stakeholders, partnerships and networks

Key stakeholders in the supply chain of pharmaceuticals are the Dutch government, healthcare insurance companies, the pharmaceutical industry, medical staff, and patients.

Current, planned and proposed measures, policies and strategies for dealing with the current pharmaceutical supplies as well as temporary and longer term interruptions

The National Institute for Public Health and the Environment (Rijksinstituut voor Volksgezondheid en Milieu) has developed a concept impact model in 2012 to determine the impact of medicine shortages on public health. This model was tested by Berenshot in 2014. The consultancy firm suggested some modifications to the model. The 'Working Group Medicine Shortages' currently works on developing new policies and strategies with regard to the supply of pharmaceuticals.

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6. Country Report – Great Britain

John Tesh and Jennifer Cole

Royal United Services Institute

6.1 Summary

Over the past twenty years, the UK has progressively adopted a risk management approach to security, in which the priority for investment in resilience to all kinds of threat and hazard, and decisions on the best means of countering them, is informed by an assessment of the likelihood of harm or disruption to key British interests, and the seriousness of the likely impacts. Supply chain resilience is for the most part regarded as a matter for the (now largely private-sector) owners and operators of essential service providers in the national infrastructure sectors; but the UK government has tempered this market-based approach with moves towards a partnership model to manage what it sees as an increasingly risk-prone security environment for energy, food and some other strategic goods and services, in the medium- to long-term future. Since the risks in these areas are global, the UK is increasingly in the market for international solutions with its traditional, and some non-traditional, partners. Increasingly also, the longer term issues for health and social policy, and for agriculture and other businesses, are being taken up in the UK's Climate Change National Adaptation Plan[237].

6.1.1 Food

The UK currently enjoys a high level of food security. But global pressure on food supplies is increasing with population numbers rising at the same time that production of some foodstuffs is being jeopardised by the impacts of climate change, such as more frequent and intense droughts and floods, and changing patterns of crop disease. Ensuring that all UK citizens have access to sufficient healthy and safe food at an affordable price is therefore a challenge which is likely to become more acute in the future.

[237] The National Adaptation Programme (Making the country resilient to a changing climate), presented to Parliament pursuant to Section 58 of the Climate Change Act 2008 in July 2013

6.1.2 Water

The UK enjoys reasonable security of drinking water supplies, and regulation surrounding the water industry has meant that it has been regarded as fairly resilient. But the 2007 floods demonstrated weaknesses when five water treatment plants and 322 water treatment plants were flooded (flooding of one of the water treatment plant in Gloucestershire resulted in piped supplies of drinking water being lost to 350,000 people for up to 17 days), and the industry struggled to arrange substitute deliveries of supplies in bowsers or bottles to customers. The 2012 Climate Change Risk Assessment suggested that UK water resources would come under increased pressure, with between 27 million and 59 million people in the UK living in areas affected by water supply-demand deficits, suggesting the need for adaptation action to increase water efficiency across all sectors (including the agriculture sector where there will be less water available for crop irrigation) and decrease levels of water abstraction in the summer months.

6.1.3 Pharmaceuticals

The NHS is one of the largest organisations in Europe and the competing demands for sustainability, efficiency, and a reduction in the costs of administering its supply chain have posed challenges for resilience; these have so far largely been overcome. The resilience of contingency arrangements for the NHS supply chain for medical devices, consumables and pharmaceuticals were subject to independent review in 2013. The sheer size of the pharmaceutical pipeline means that the NHS does not normally need to stockpile medicines; but successive National Risk Assessments have pointed to the exceptional need to expand the stockpile that has existed since the 1970s, for two contingencies: an influenza pandemic, and a bioterrorist attack. For the future, the main risks to pharmaceutical resilience seem to be posed by anti-microbial resistance, and the main opportunities for risk mitigation are through scientific advances.

6.1.4 Energy

The 2014 Energy Sector Resilience Plan suggests that each sub-sector has invested proportionately to build resilience to major risks, but the size of infrastructure and networks mean improvements can take years to complete. In the longer term, falling UK production of oil and gas, coupled with sustained demand, indicate a need to import increasing amounts of both, even with the introduction of policies to promote low carbon energy and energy efficiency, and therefore a need to engage with energy producers in order to access secure, diverse and affordable supplies essential to economic stability and growth. The 2010-2015 security tasks for energy security included: giving energy security a greater voice in the National Security Council, and a higher priority in UK foreign policy; working with the EU, the International Energy Agency and other international institutions; developing and using early warning capabilities to help anticipate disruption to the transit of energy supplies; and improving the functioning of domestic energy markets.

6.1.5 Scope

This chapter, on the UK approach to supply chain resilience, takes the form of a survey of government or other official documents dealing with various aspects of security of supply of strategic goods i.e. goods or services that are essential to the wellbeing of the British people and/or the economy.

Some key definitions are:

- 'Supply Chain' is a "network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate consumer" [238]. Most work on risk management done in recent years has taken a holistic approach to improving the security and resilience of the network as a whole, and to understanding the links between many of these essential services so that the impact of a vulnerability in one on others can also be mitigated. Questions of affordability or safety, which form part of some widely used definitions[239], are not addressed.
- 'Resilience' is defined here as the quality of systems that enables them to withstand sudden shocks, maintain key functions during the ensuing crises, and recover to the previous or an acceptable new equilibrium; this quality also enables them to adapt to longer-term changes in the risk environment.
- 'Risk' is 'an uncertain consequences of an event or activity with regard to something that humans value'[240], measured in its simplest form as a product of the likelihood of such an event and the possible impact.
- 'Risk management' is accordingly a process of addressing all aspects of risk (so: hazard origin; exposure; vulnerability; impact) so as to reduce the risk overall through one or more of the available measures of

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[238] The British Standards Institution's published document (i.e. not a standard) on supply chain continuity defines 'supply chain' as a "network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate consumer" PD 25222:2011 Business continuity management – Guidance on supply chain continuity

[239] For example, the UN Food and Agriculture Organisation defines food security as "when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life".

[240] Kates, R.W, C. Hohenemser and J.Kasperson (1985): *Perilous progress: Managing the Hazards of Technology,* Westview Press, Boulder

anticipation, prevention, protection, response, and consequence management).

The facilities, systems, sites and networks which deliver the essential services on which human welfare and the economy depend are collectively known as the 'National Infrastructure'[241]; within this, the government catalogues elements whose loss or serious disruption would cause major harm as 'critical national infrastructure'. The growing interdependence of these networks on each other and on other sections of the economy means that there is pressure to add to an already long list of critical and not-so-critical assets; but at present the Government distinguishes nine national infrastructure sectors, and a further two heavily regulated sectors (nuclear power; other potentially hazardous sites) which do not formally qualify as NI but are subject to a similar approach.

6.2 Overview

6.2.1 General description of how the UK is dealing with the risks of disruption to supplies of essential goods and service

In the years following the end of the Cold War, governments discovered that UK national infrastructure enjoyed a relatively high level of security against traditional security threats, which provided a good basis for security against the new threat posed by international terrorism and, to a lesser extent, organized crime. But privatization in the 1980s of many of the previously publicly-owned assets in the national infrastructure sectors had the effect of reducing some of the resilience that they had previously had to disruptions caused by natural hazards and man-made incidents; and the increased adoption of more efficient practices (removal of redundancy; 'just-in-time' supply chains) rendered some key services vulnerable to disruptions in the supply chain both downstream and upstream. In some sectors (in particular food) the effects were masked because of the abundance of alternative sources of supply in the market. In others (e.g. energy, water) short-term disruptions were at first tolerated but increasingly became a source of criticism both of the industry and of the government.

6.2.2 The Government Strategic Response

The Government's initial response to these near-term risks of disruption was to reinforce central government machinery (the so-called COBR system) for managing emergencies at the national level, and introduced legislation (the 2004 Civil Contingencies Act, which came into effect in 2005) to encourage effective teamwork at the local level between front-line emergency responders and representatives of utility companies (as so-called 'category 2 responders').

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[241] The UK government distinguishes eleven national infrastructure sectors. A table of these is presented in Appendix 7.1 at the end of this report.

These measures – in particular the machinery for local cooperation between front-line and category 2 responders – had not yet properly bedded in by 2007, when extensive and prolonged flooding in England exposed the lack of resilience of many elements of the national infrastructure. The Government then decided to recognize the need for improved resilience of national infrastructure sectors as part of a new National Security Strategy[242] which addressed not just the concerns for the security of the State, but also the safety of its citizens, against all kinds of hazard and threat including not only war and terrorism but also the harmful and disruptive effects of natural hazards and major accidents.

The 2010 version of the national security strategy[243] took this a stage further, by looking at changes and trends that were evident in the UK and global landscape[244] and at what demands they might make on public policy in the mid- to long-term future. Most of these developments have the potential to pose risks (as well as opportunities) for the security and resilience of supplies of goods and services essential to the wellbeing of UK citizens and economy.

This high degree of exposure of the UK to events in the wider world persuaded the government, in 2010, to reject a policy of 'strategic withdrawal' from international engagement and to opt instead to pursue two 'complementary strategic objectives' of ensuring a secure and resilient UK (protecting people, the economy, infrastructure, territory and way of life from all major risks that affect them directly); and 'shaping a stable world' (reducing the likelihood of risks affecting the UK or its interests abroad by tackling them at source). The risks of strategic overstretch that this dual approach entails is partly mitigated by prioritizing the risks according to their likely impact, and the timescale in which they are likely to be realized.

6.2.3 National Risk Assessment

In order to be able to assess the potential for risk to UK security interests posed by these global trends, and to aid prioritization of effort within and between the two strategic security objectives, the UK government carries out national risk assessment in two time-frames:

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[242] The first ever UK National Security Strategy (subtitled "Security in an interdependent world") was presented to Parliament in March 2008 as Cm 7291

[243] Cabinet Office: National Security Strategy ("A Strong Britain in an Age of Uncertainty" – Cm 7953 published October 2010)

[244] These included the shift in economic power from the developed economies of the OECD towards the rising economies in Asia, Latin America and the Gulf; the increasingly multi-polar distribution of power; the increasing interconnectedness of the world, both through technology, travel and migration and through the global trade in goods, services and travel; the pace of scientific and technological innovation, including in the biological sciences; the changes in the nature of the risk of conflict; social and demographic trends; environmental factors, in particular through climate change; and greater demand for scarce natural resources.

1. National Risk Assessment (NRA), looking forward up to 5 years, that analyses the risk of harm and disruption to the UK through the recurrence in the near future of domestic 'civil contingencies' or emergencies. These are defined as events or situations – accidents, natural hazards, terrorism or war - that threaten serious damage to human welfare or the environment in the UK. Serious damage is defined as: loss of human life; human illness or injury; homelessness; damage to property; disruption of a supply of money, food, water, energy or fuel; disruption of a system of communication; disruption of facilities for transport; or disruption of services related to health. The NRA therefore assesses the risks of destruction or disruption to the national infrastructure facilities that produce these essential services including facilities for the reception, production or distribution of food, water, and energy supplies. The analysis of risk is used to secure a consensus within government on the priority to be given to risk reduction, to target the risks or their impacts most in need of mitigation in each area, to guide thinking on the relative emphasis to be given to the different components of risk management strategies (i.e. prevention versus response), and to enable cross-departmental programmes to build capability[245] and capacity[246] for response and recovery.

2. National Security Risk Assessment (NSRA), first produced in 2010 and being reviewed this year, which looks at the full range of risks to national security which might materialize over a 5 and 20 year horizon. This includes all major areas of national security risk – domestic and overseas – that are of a sufficient scale or impact as to require action from the government. As with the NRA, the NSRA involves an assessment of the relative likelihood of the risks, and the relative impact based on the potential direct harm a risk could cause to the UK's people, territories, economy, key institutions and infrastructure. The intention is to provide an insight into potential future risks rather than immediate security issues, so giving the UK strategic notice about future threats, or changes to existing threats, enabling the government to plan its response and capabilities well in advance. The priority risks identified in this first NSRA were the threat of international terrorism, hostile attacks on UK cyber space, a major accident or natural hazard, and an international military crisis between states; and these priorities have informed UK strategy in the period 2010-2015. But the NSRA also pointed up the longer-term risks of disruption to oil or gas supplies as a result of war, accident, major political upheaval or deliberate manipulation of supply by producers; these risks,

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[245] For the purpose of this paper, a 'capability' is understood to mean human and technical means to accomplish a mission, function or objective that is necessary to achieve national preparedness and resilience goals; capabilities may include people, their training and skills, plans and planning processes, equipment, supplies, logistics, exercises, and legislation.

[246] 'Capacity' here is understood to refer to the quantitative dimension of capability i.e. whether there is enough of a capability or capabilities to achieve the state of readiness required.

together with the risk of short- to medium-term disruption to international supplies of other resources, including food, essential to the UK, were identified as 'tier 3' risks which implied, not that they would be neglected but that, for the time being, they would enjoy a lower priority for government-wide effort than the higher tier risks.

Accordingly, the focus of work on the national infrastructure sectors, within the overall five year plan for 2010-2015[247], has been as follows:

I. To build resilience in all national infrastructure sectors against the existing range of common hazards and threats, in the round, with priority being given to correcting deficiencies in resilience to the top risks in the NRA

This followed the recommendations of the 'Pitt Report'[248] on learning the lessons from the 2007 floods in organizing a national programme, focusing on the utilities and involving a tri-partite collaboration between the owners and operators of critical assets and networks, the government (all sponsoring departments with coordination from the Cabinet Office) and the regulators. The national programme had three main components:

1. Agreement on a 'Guide' to improving the resilience of critical infrastructure and essential services[249]. The guide adopted government policy that the main responsibility for the resilience of critical infrastructure lay with the owners and operators, and rejected the option of more regulation, or standardization, in favour of a voluntary risk-based approach. The principles were that investment in security and resilience would be proportionate to the risks, enabled by a sharing of information between the different stakeholders, and delivered at the lowest practicable level. This last was a reference to the perceived reluctance of some utility companies to participate and share information fully in 'local resilience fora' established for emergency planning purposes under the 2004 Civil Contingencies Act. The infrastructure owners and operators gained agreement from the regulators that the costs of resilience measures would not come out of their 'bottom line', thus correcting a disincentive in the previous pricing

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[247] set out as 'national security tasks in the Strategic Defence and Security Review ("Securing Britain in an Age of Uncertainty" – published by the Cabinet Office as Cm 7948 in October 2010)

[248] "Learning lessons from the 2007 floods" – final report by Sir Michael Pitt dated June 2008 on the lessons identified from the 2007 floods in England. http://webarchive.nationalarchives.gov.uk/20100807034701/http://archive.cabinetoffice.gov.uk/pittreview/_/media/assets/www.cabinetoffice.gov.uk/flooding_review/pitt_review_full%20pdf.pdf

[249] Cabinet Office: Keeping the Country Running: Natural Hazards and Infrastructure (published October 2011)

formulae to investment in resilience to the more common natural hazards. Cross-fertilisation of ideas on resilience was encouraged through the creation of a government-industry forum where the problems posed by the inter-dependence of the infrastructure sectors could be discussed. The clear aim was to bring together security and resilience to all kinds of threat and hazard under one umbrella.The guide itself summarises an approach to infrastructure which combines the following:

- resistance (direct physical protection)
- reliability (the ability of infrastructure to maintain operations under a range of conditions)
- redundancy (for example, back-up facilities or the ability to by-pass blockages in a network and reduce 'single points of failure')
- response and recovery, and
- Supply chain resilience.

2. Co-sponsorship of a number of British Standards or published documents designed to promote business resilience across the economy, including: business continuity (BS 25999), Organisational Resilience (BS65000), and supply chain continuity (BSI PD 25222:2011). In part the initiative to improve general standards of business continuity was taken in order to reduce vulnerability of small and medium sized businesses many of which are key elements of the supply chain for larger corporations owning and operating national infrastructure.

3. Development by sponsoring government departments, working with representatives of the infrastructure sector, of Sector Resilience Plans for Critical Infrastructure, starting with the first set of plans in 2010/11 which summarized the then assessed level of resilience in each sector, but going on to outline the approach each sector would take in improving on current levels of resilience. Although some of the information is sensitive, summaries are published on the Cabinet Office website[250].

The 'top risks' in the NRA are those that have the highest likelihood of happening and the greatest impact if they do. At the time of the 2010 SDSR, these were terrorist attacks using 'unconventional' materials (i.e. mass effect weapons), major tidal or coastal flooding; and an influenza pandemic. Since

[250] See, for example, Cabinet Office: A Summary of the 2014 Sector Resilience Plans published on the UK government website GOV.UK in August 2014

then, the risk of a widespread and prolonged electricity supply outage has come more to the fore. In view of the potential speed of onset of these kinds of contingency, the government has invested in strategic stockpiles of equipment or supplies that would be needed more quickly and in greater volume than the market could reliably provide; but generally, there is limited appetite for stockpiles because of their expense.

II. To continue to manage the risks inherent in the UK's growing dependence on imports of oil and gas, and to analyse and assess the critical risks of disruption to other strategic goods in order to understand how to manage them before they materialize in the UK.

The 2010 Strategic Defence and Security Review prioritised energy security, the challenges of which had been well understood since the UK first became a net energy importer in 2009. For the other critical national infrastructure sectors, the SDSR undertook to "improve the government's ability to consider and tackle the range of risks associated with other resources, such as key mineral components important for particular industries (e.g. rare earth metals which are crucial for some low carbon technologies), water and food".

The government recognized that these risks might arise as a result of competition for resources among or within other countries and would certainly involve improving the Government's ability to understand and respond to the national security impacts of climate change. Accordingly, the following couple of years saw a number of pieces of strategic analysis, including the The Climate Change Risk Assessment (CCRA).

The CCRA[251] is required under UK climate change legislation (the 2008 Climate Change Act) and examines the potential impact of climate change in the UK in five main areas: the agriculture and forestry sector; the building and infrastructure sector; health and wellbeing; business; and the natural environment. The CCRA presents a range of potential climate impacts, within three timeframes (the 2020's; the 2050s; and the 2080's) and consistent with the UK Climate Projections published by DEFRA in 2009. A variety of scenarios is assessed from a low emissions scenario to a high emissions scenario.

Since the CCRA is an assessment of domestic risks to the UK, the Government also commissioned a report from its Chief Scientific Adviser on the international dimensions of climate change which emphasized the potential

[251] UK Department for Environment and Rural Affairs (DEFRA): 2012 Climate Change Risk Assessment published January 2012 pursuant to Section 56 of the Climate Change Act 2008

disruptive impact on infrastructure, energy supplies, global food production, the extraction of vital raw materials.[252]

A series of government reports and studies on the policy implications of pressures and risks arising from the main developments identified in the National Security Strategy including a cyber security strategy, a renewed counter-terrorism strategy, and a number of studies and policy papers on energy and food security (see below).

A new Strategic Defence and Security Review, covering most of these issues, is currently underway, following a three year programme to update and review the National Security Risk Assessment.

6.3 Food and drinking water supplies

6.3.1 Current situation

The food and drink industry comprises elements of food manufacturing and wholesale and retail supply chains.[253] The lead Department within Government is the Department for Environment, Food and Rural Affairs (DEFRA); the Food Standards Agency (FSA) deals with food safety or contamination issues. DEFRA works with the food industry through a Food Chain Emergency Liaison Group (FCELG) which meets 3 to 4 times a year to consider any disruptive challenges to the industry. DEFRA has lead responsibility for responding to a disruption to food manufacturing or distribution in England but has no statutory powers to intervene in the industry in an emergency and sees no current need to do so other than, possibly, under a declared state of emergency under Part II of the Civil Contingencies Act. Responsibility for responding to

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[252] UK Government Office for Science: International dimensions of climate change (published 11 July 2011 on GOV.UK website). Executive Summary suggests:

> "Adverse economic impacts could affect overseas resources and infrastructure on which the UK depends. A wide range of potential threats are identified including disruption to vital infrastructure serving global markets, disruption to energy supplies, global food production, the extraction of vital raw minerals, the impact of extreme weather events on communications networks and data centres, and a growing threat of protectionist responses from countries adversely affected by climate change. For example, the UK is a new energy importer and had an energy deficit of £8.2 billion in 2009. Climate change may disrupt critical infrastructure (for example pipelines, ports and overseas refineries) affecting the price and security of UK energy imports."

[253] These include: fishing and fish farming primary producers, the agricultural supply industry (animal feed manufacturing, agricultural machinery, fertilizers and pesticides), distribution networks for primary produce, agricultural wholesalers, the food and drink processing, manufacturing and supply industries, grocery retailers, caterers, and imports (some £23 billion in 2012).

disruptions in food supply is a devolved matter in the rest of the UK (i.e. it is the responsibility of devolved administrations/governments in Scotland, Wales and Northern Ireland). If it came to it, the responsibility for feeding displaced person or local populations during an emergency falls initially to local authorities.

The 2014 summary of resilience plans for the food sector[254] reports that the UK food sector has a highly effective and resilient food supply chain, owing to the geographic spread, number of firms and competitive nature of the industry. Although there is a widespread dependency on other essential services (power, fuel, water telecommunications - including SCADA - systems, and transport) the sector's resilience to disruption of these has been demonstrated in recent years and, in particular, during the 2007 floods.

The commercial pressures of the food sector have created a just-in-time culture that requires an immediate response to disruption of production or supply. But, the number of supply chains and the manufacturing and retail options available, coupled with the high degree of substitutability of foodstuffs in the industry, makes the sector resilient to disruption.

The sector is currently following up the findings of recent government research on the resilience of the food supply chain to port disruption and 'pinch points' created by disruption of fuel supplies. Further work is expected to look at the food industry's ability to respond to and recover from a major coastal flooding event. Threats to the food and drink industry from food fraud were highlighted in an independent review published in September[255]. Other work on current issues includes:

- Further development of Publicly Available Specification (PAS96 – a form of guidance falling short of a British Standard) on "defending Food and Drink" to include the threat of criminality/fraud.
- Publication of a report on Plant Health by an expert task force in May 2013, followed by publication of a plant health risk register in January 2014, appointment of a new Chief Plant Health Officer in April 2014 and publication of a Plant Biosecurity Strategy in April 2014 [256]

[254] Cabinet Office: A Summary of the 2014 Sector Resilience Plans

[255] The Elliot review into the Integrity and Assurance of Food Supply Networks – Final Report "A National Food Crime Prevention Framework" dated July 2014 and published September 2014

[256] See www.gov.uk/defra - "Protecting Plant Health - a Plant Biosecurity Strategy for Great Britain" April 2014 Plant Biosecurity Strategy in April 2014

6.3.2 Longer term risks to the food supply chain

The UK is not self-sufficient in food (the British import nearly £40 billion of our food[257] and the National Farmers' Union estimates that the food now produced in the UK amounts to 60% of what is needed to be self-sufficient), so the high degree of food security in the UK at present stems in part from the abundance of food produced by other countries. Much of the government's attention is focusing on the growing pressure on the global food system and the implications for policy makers in the UK in the future.

A report by the Government Office of Science's Foresight team[258] summarized the global problem as follows:

> "The global food system will experience an unprecedented confluence of pressures over the next 40 years. On the demand side, global population size will increase from nearly seven billion today to eight billion by 2030, and probably to over nine billion by 2050; many people are likely to be wealthier; creating demand for a more varied, high-quality diet requiring additional resources to produce. On the production side, competition for land, water and energy will intensify, while the effects of climate change will become increasingly apparent. The need to reduce greenhouse gas emissions and adapt to a changing climate will become imperative. Over this period globalization will continue, exposing the food system to novel economic and political pressures"

The report argues for an international, cross-boundary, approach (i.e. one that coordinates policy with other international actors in the food system, but also coordinates food security policy with policy in other sectors including energy, water supply, land use, the sea, ecosystem services, and biodiversity) to meet five challenges:

- Balancing future demand and supply sustainably – to ensure that food supplies are affordable
- Ensuring there is adequate stability in food supplies – and protecting the most vulnerable from the volatility that does occur
- Achieving global access to food and ending hunger (recognizing that producing enough food in the world so that everyone can potentially be fed is not the same thing as ensuring food security for all)

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[257] HMRC figures for exports and imports are presented in Appendix 7.2 at the end of this report.

[258] Foresight. The Future of Food and Farming (2011)("Challenges and choices for global sustainability"). The Government Office for Science, London

- Managing the contribution of the food system to the mitigation of climate change
- Maintaining biodiversity and ecosystems while feeding the world

See Appendix 6.3 (at the end of this report) for further references to official reports tracking the development of UK policy subsequent to the Foresight report.

6.4 Water

6.4.1 Current situation

The water management system was set up in 1963 and has seen a number of reforms since, more significantly in the privatization in 1989 of the 10 Regional Public Water Authorities, based on catchment areas rather than municipal or other administrative boundaries. The current industry comprises 29 water companies still based on catchment areas and providing either water only or water and waste-water services. DEFRA provides the strategic policy direction and statutory framework. Water UK is the trade body for the UK water industry, providing representation for all UK water and waste-water service providers at national and European level, and engaging with government, regulators (OFWAT), stakeholder organisations and the public. OFWAT is responsible for economic regulation of the industry, consulting the Drinking Water Inspectorate, the Environment Agency and the Consumer Council for Water. In 2012, the water industry infrastructure comprised 1,162 water treatment works, 373 wastewater treatment works, 4,262 service reservoirs and about 345,000 kilometres of main pipelines.

6.4.2 Legislation

Water is a devolved issue with separate legislation for England, Scotland, Wales and Northern Ireland. For England, the obligation on water companies to build in resilience is implied in the Water Industry Act 1991 and the Security and Emergency Direction 1998 (which is the water industry equivalent of the British Standard on business continuity and is the only example of a national infrastructure service provider being required to make plans to provide a specific fall-back service in the event of disruption of the primary means of supply). As category 2 responders under the Civil Contingencies Act, water companies are also obliged to make plans to prevent or mitigate emergencies, and cooperate and share information with front-line responders. In 2004, the Water Council UK established a 'mutual aid' protocol for all members to ensure delivery of water[259] by companies in an emergency; and this facilitates inter-

[259] This built on the experience/lessons identified from the Severn Trent/Gloucester experience in 2007 floods of the difficulty in delivering and resupplying water bowsers in narrow country lanes, and the logistics of bottled water distribution.

company borrowing of emergency equipment from the considerable stockpiles held by the various companies during severe incidents; and this protocol was revised in 2009.

6.4.3 Capabilities

As part of the Cabinet Office's National Resilience Capabilities Programme, DEFRA works with the water industry to develop capabilities to manage the risks affecting the industry, using the NRA to explore vulnerabilities that need to be addressed. Over the past few years, the key vulnerabilities have been the industry's dependence on a supply of electricity (to pumping stations), telecommunications (impacting water companies' SCADA – Supervisory Control and Data Acquisition – systems) and chemicals (essential to water and waste-water treatment operations which were substantially disrupted of access during the flooding in 2007, and the snow in January 2010).

Following direction from DEFRA that proportionate costs of resilience should be allowed for in pricing formula for water supply, Ofwat's determination on water company prices in November 2009 provided for some £400 million over five years to make plants more resilient, and the Water Act 2014 contains a variety of measures to boost resilience further, including a primary resilience duty for Ofwat, and a power for the Environment Secretary to direct water companies to plan for a certain level of resilience. Other measures designed to improve innovation and efficiency are also in prospect.

6.4.4 Longer term risks to the water supply chain

The 2012 Climate Change Risk Assessment highlighted water distress as a future risk, particularly for areas like the South-East which are already prone occasionally to drought and where population levels have been rising. As part of action being undertaken to improve long term resilience, water companies produce Water Resource Management Plans setting out how they intend to provide supplies of water to customers over the next 25 years and beyond[260].

6.5 Pharmaceutical supplies

6.5.1 Current situation

The health sector is a large, complex, interconnected set of healthcare services. The Department for Health provides strategic direction and a statutory framework. The 2004 Civil Contingency Act and the NHS Operating Framework Emergency require the NHS to respond safely and effectively to

[260] See for example Trent Water's 2015 Water Resources management plan, which includes a 25 year demand forecast describing how much water its customers will need in the future, considering factors such as climate change and population, and a 25 year supply forecast showing how much water is available for use now and how this may change in the future. http://www.severntrent.com/future/plans-and-strategy/water-resources-management-plan

major risks. The Sector Resilience Plan assesses resilience as inherently good, as a consequence of the size of the service, the fact that most healthcare services and supplies are replicated throughout the UK and there are well-tested mutual aid agreements in place, and the attention paid to emergency response in the past ten to fifteen years which have seen *inter alia* a Publically Available Specification (like a British Standard) tailored specifically to the circumstances of the sector. The NHS remains somewhat vulnerable to disruptions to other services (utilities, especially electricity, transport and fuel supply) and to the fact that the service has to operate at near full capacity all the time and many subsidiary organisations are too busy to devote time to business continuity.

In 2014, the resilience plan for health had the following elements:

- A review of the resilience across the health sector to fuel shortages (which forms part of the wider review by the Department for Energy and Climate Change of the national emergency plan for fuel)
- A review, with the Department of Communities and Local Government, of lessons identified after the winter 2013-14 flooding for improving the operation of the residential care sector provides support
- Development of a pilot National Resilience Capabilities Assessment to identify and assess means of responding to a mass casualty event
- Work with Cabinet Office on response to the risk of an effusive volcanic eruption
- Development of a process for ensuring effective communications across the health sector in the event of an emergency

6.5.2 Pharmaceutical Stockpiles

Medical supply problems can occur for a number of reasons, and there is a team within the Department of Health (DH) which deals specifically with such problems, both in the community and in hospitals. The teams works with the Medicines and Healthcare Products Regulatory Agency (MHRA), the pharmaceutical industry, the National Health Service (NHS) England and others in the supply chain to prevent shortages. One facility is the UK Essential Medicines Buffer Stock (EMBS) which was set up in 2009 to make the supply chain more robust in the event of a pandemic or other emergency, but has also proved important in addressing short term supply shortages. When there is no UK stock available, and it is considered appropriate, a release of medicines from the EMBS into the supply chain ensures that supply to patients is maintained. Contracted suppliers rotate the stock to provide a cost effective system that provides a stockpile that is immediately available and with at least 12 months expiry date.

In addition to the EMBS, there has for a number of years existed a specific CBRN stockpile which does not include the essential stocks for more general

use in the UK NHS. The CBRN stockpile is maintained and managed by the UK government and is available to all of the UK health departments. (Health is devolved in the UK to England, Scotland, Wales and Northern Ireland but they work together when it comes to managing stockpiles).

The current main stockpile includes some twenty-plus products. It is based primarily on the assessed risk of an infectious disease pandemic and of a bioterrorist attack, in the National Risk Assessment, and on whether the supplies are generally available in the NHS. Only those which are not usually available are stockpiled. The total replacement value is over £100 million, so there is quite a considerable stockpile available for use in the UK.

There are protocols for release, and these depend on the need and speed of wanting them in place. There are items that can be distributed to particular areas within twenty-four hours and a number that can be distributed within a shorter timeframe. An advantage of the UK being relatively small is that it is possible to get items around the country rapidly if needed.

The CBRN stockpile started in the late 1970s. When smallpox was eradicated, the vaccine was retained against the event that the disease should re-emerge. After the Tokyo Sarin gas attacks, it was decided that the UK needed to have nerve gas antidotes in order to respond quickly if an attack of that sort happened here. Further enhancements were made in 2002 and 2003 following 9/11, looking particularly at countermeasures for anthrax and botulinum toxin. Further enhancements made after 2003 enhanced the amount of nerve agent countermeasures and personal-protection equipment. This is stockpiled out in the field to ensure it is ready for rapid use if needed.

There is also a more central stockpile containing antibiotics for bacterial biological agents. It includes products to deal with elements of radiation exposure, including potassium iodate, which was already in place for the UK's nuclear installations but a further stockpile has been generated nationally. More smallpox vaccines have been brought in to supplement the stores stockpiled previously and there are some specific antidotes to deal with particular types of chemical poisoning. Additional products including specialised needles and syringes, if required, have also been added.

During the London 2012 Olympic and Paralympic Games, a stockpile of pharmaceuticals for pandemic flu was available, if needed, to use for CBRN issues. This enabled a single stockpile to provide for pandemic flu, outbreaks of new infectious diseases, a catastrophic CBRN attack, a smaller-scale CBR attack or an industrial accident involving hazardous chemicals.

The countermeasures stockpile remains under review to see whether it is proportionate to the anticipated threats or hazards and consistent with clinical guidelines. The review has looked at whether it is realistic in terms of the timescales allowed for managing the logistics and distribution of stocks and whether it represents value for money within the risk appetites of each of the UK administrations.

6.5.3 Longer term risks to pharmaceutical resilience

In future, the biggest challenge to health is not directly a supply chain issue but the development and spread of Anti-Microbial Resistance (AMR), which occurs when drugs are no longer effective in treating infections caused by micro-organisms. In the UK, the numbers of infections complicated by AMR are expected to increase markedly over the next 20 years. In this year's National Risk Register[261] (a public version of the NRA) the government reported that, if a widespread outbreak were to occur, the UK could expect around 200,000 people to be affected by a bacterial blood infection that could not be treated effectively with existing drugs, and around 80,000 of these people might die. High numbers of deaths could also be expected from other forms of antimicrobial resistant infection. AMR is a global problem and the UK Government is working with international partners to secure support for concerted action at a global level. Coordinated international action is needed to tackle AMR as a priority issue through the World Health Organization (WHO) and other UN bodies.

At a UK level, the Department of Health, the NHS, the Department for Environment, Food and Rural Affairs and the Veterinary Medicine Directorate are working together with other partners to lead the implementation of the UK five-year Antimicrobial Resistance Strategy, published in September 2013[262]. A cross-government high-level steering group comprising government departments and agencies and the devolved administrations published the measures which are being used to assess the impact of the actions being taken across the UK to reduce the spread of AMR and improve antibiotic prescribing. The high-level steering group's *Progress report and implementation plan* was published on 11 December 2014[263]. In addition, in July 2014, the Prime Minister commissioned an independent review of AMR, chaired by Jim O'Neil, of how the development of new antibiotics can be stimulated and how best to encourage innovative thinking and research in order to change methods for treating infectious diseases. The review has already produced two reports. The first of these – *Antimicrobial resistance: Tackling a crisis for the health and wealth of nations* – appeared in December 2014. It quantifies the likely global economic burden of AMR between now and 2050. The second – *Tackling a global health crisis: Initial steps* – was published on 5 February 2015. It describes steps that could and should be taken now in the international effort to tackle AMR. Further reports are expected to be published during 2015. By

[261]https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/419549/20150331_2015-NRR-WA_Final.pdf
[262]https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/244058/20130902_UK_5_year_AMR_strategy.pdf
[263]https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/385733/UK_AMR_annual_report.pdf

the summer of 2016, the review will recommend a set of actions to be agreed on at an international level in order to deal with the challenge of AMR.

On the opportunities side, technological advances including, in particular, synthetic biology offer potentially significant gains to pharmaceutical security and resilience in both the medium and long term. In the medium term, it could offer modifications to existing pathways for pharmaceutical production. In the longer term, there is the potential for self-sufficient pharmaceutical generation, reliant only on basic raw supplies and even the prospect of developing pharmaceuticals tailored not only to specific infectious organisms but also to the host.

6.6 Energy supplies

6.6.1 Current Situation

The Energy sector is made up of the upstream oil and gas, downstream oil and gas, electricity generation and electricity networks. Major risks to the sector are flooding, including coastal flooding, storms and gales, and loss of key staff. To build resilience to these and other risks, energy companies:

- Adopt an all-risks approach: Under the Utilities Act 2002, the regulator Ofgem introduced performance levels for the gas and electricity industry including supply restoration timescales; and a ”RIIO“ performance standard for network companies’ price control periods to ensure efficient investment for continued safe and reliable services
- Address specific vulnerabilities: Companies are implementing a large programme of flood protection measures, which is due for completion by the early 2020s
- Put in place contingency arrangements: Energy companies have worked extensively to put in place contingency plans in the event of disruption due to severe weather related events and to manage staffing in the event of pandemic influenza.

Owing to the size and complexity of energy networks, completion of programmes can take a number of years, meaning that while vulnerabilities are being addressed, there is an on-going, but reducing, risk of disruption. Priorities include:

- Upstream Oil and Gas: Assessment of the risk to oil and gas beach terminals from fluvial and coastal flooding.
- Electricity Generation: Assessment of the risk to power stations from fluvial and coastal flooding.
- Electricity Networks: Assessment of the risk posed by severe space weather and cyber-attack

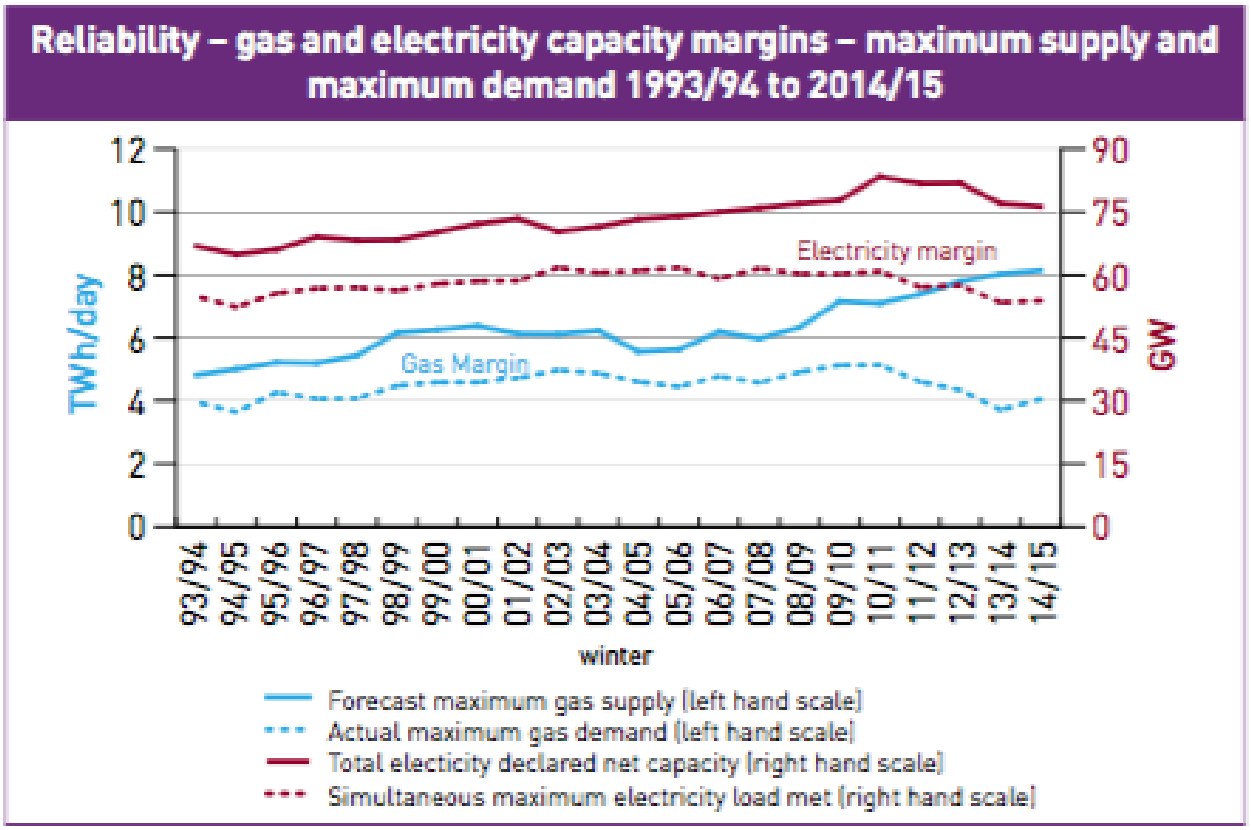
- Downstream oil: working on maintaining capability to make fuel deliveries in the event of a serious disruption.

The separate infrastructure resilience plan for the nuclear energy sector sets out Government policies to minimise the risk of civil nuclear emergencies domestically or internationally, which takes into account lessons identified from real incidents – such as Fukushima in Japan – and includes an extensive exercise programme led by the Office for Nuclear Regulation.

For oil, the UK as a member of the EU and the IEA is required to hold emergency stocks. Under the EU obligation, the UK holds 67.5 days of oil consumption in stocks. An IEA coordinated release of strategic oil reserves remains our primary tool to combat a significant supply disruption to international oil markets.

Energy security is complex to measure, but the annual government report[264] looks at the difference between maximum supply and demand for gas and electricity as key indicators. The 2015 report – illustrated by the table below - concluded that the electricity capacity margin has mainly increased year on year over the past decade due to both a decrease in peak demand and an increase in capacity but that, in 2014/15, a slight increase in demand and fall in capacity due to plant closures and conversions resulted in the capacity margin falling to 42%. For gas, there has been a year on year increase in the capacity margin, with the large increase from 2011/12 and 2012/13 as a result of reduced demand and increased supply. Reductions in gas demand in recent years have been due to a switch from gas to coal for power generation and relatively muted domestic demand due to relatively warm weather.

[264] UK Energy in Brief 2015, published on GOV.UK by the Department of Energy and Climate Change, based mainly on the 2015 edition of the "Digest of UK Energy Statistics", published on 30 July 2015. Details of the Digest and other Department of Energy and Climate Change (DECC) statistical publications can be found on pages 43 and 44 of this booklet and are available on the Internet at: www.gov.uk/government/organisations/department-of-energy-climate-change/about/statistics



Source: National Grid and DECC

6.6.2 Longer-term risks to the energy sector

The 2010 Strategic Defence and Security Review reported that falling UK production of oil and gas, coupled with sustained demand, would make UK increasingly reliant on fossil fuel imports. Without low-carbon policies, net oil and gas imports would rise rapidly: low carbon policies could help to reduce this demand (and encourage others to do the same) but UK would still need to import considerably more than at that time. UK faces a number of risks to its ability to access secure, diverse and affordable supplies of energy essential to economic stability and growth including: political instability in key energy countries, insufficient investment in states that supply energy, and other imperfections in the functioning of global and UK markets. And these risks are set to intensify.

The latest government statistics show that, in 2014, 46% of energy used in the UK was imported[265] and that UK imports are sourced from a wide variety of countries.

[265] Latest comparable data from Eurostat, for 2013, show that the UK had the ninth lowest level of import dependency in the EU, behind Estonia, Denmark, Romania,

Coal: Russia remained the leading source accounting for 42% in 2014, followed by the US 26% and Columbia 23%. The vast majority of coal imported, was steam coal which accounted for an 87% share, mainly for electricity generation.

Crude oil: The key source of imports is Norway, which in 2014 accounted for 45% and with OPEC countries supplying a further 36%.

Petroleum products: The UK imports a wide variety of petroleum products, though remains a net exporter of certain fuels including petrol. Traditionally, the Netherlands has been the largest source of imports, which acts as a major trading hub. However, Russia is now the largest supplier of transport fuels, in particular diesel. Aviation Turbine fuel is generally sourced from Asia.

Gas: Norway accounted for 57% of UK gas imports in 2014, with pipelines from Netherlands and Belgium supplying 15% and 1% respectively. The remaining 27% arrived as Liquefied Natural Gas (LNG), of which 92% was from Qatar.

The latest comprehensive energy security strategy to manage the risks that arise was published by the then (coalition) government in 2012[266]. These include both demand and supply measures[267] including improving the reliability of networks and decarbonising supplies.

Increasingly, however, the UK is working with international partners to tackle the energy security issues in the medium to long term future, and the government has coined the phrase 'energy diplomacy' to cover: the promotion of low carbon technologies and energy efficiency to restrain rising oil and gas demand, encouragement of global investment in oil and gas production, greater liberalisation of energy markets, and strengthened trading links and infrastructure. This includes work at a European level, in particular to implement the requirements of the latest suite of European legislation aimed at establishing a single market in energy across the EU, to improve EU market integration and increased cross-border trade for both electricity and gas. To enhance energy price stability, Government continues to support producer/ consumer dialogue and greater market transparency and is an active member of the International Energy Forum (IEF), which brings together all the main oil producing and consuming countries.

Poland, Netherlands, Czech Republic, Sweden, and Bulgaria. All EU countries are now net importers of energy.

[266] Energy Security Strategy published as Cm 8466 in November 2012 by the Secretary of State for energy and Climate Change

[267] See also: The Energy Efficiency Strategy: The Energy Efficiency Opportunity in the UK, DECC 2012. http://www.decc.gov.uk/en/content/cms/tackling/saving_energy/what_doing/eedo/eedo.aspx

Europe more generally may in future face potential difficulty in securing supplies amidst tensions between Russia and Ukraine. Given the likelihood that the UK will need to increase imports of oil and gas in future, a secure supply from Europe is in the UK's interests. A European stress test, conducted in 2014 after Russia ceased gas supplies to Ukraine, emphasized the need for cooperation and solidarity between countries to ensure consistency in supply. It found that, even with flow adjustments geared towards greater energy sharing between European countries, the EU and the Energy Community Contracting Partners would be missing 5-9 bcm of gas, with Eastern European countries being most heavily impacted.[268] Increase cooperation with European countries would assist the UK in its supplies. Another consideration for this may also be the likelihood of a UK exit from the European Union, which should be taken into consideration for the country's energy security.

Appendix 6.1 – The UK government's eleven national infrastructure sectors

Sector	Sub-sector	Sector resilience lead
Communications	Broadcast	Dept for Culture, Media and Sport
	Postal	Dept for Business, Innovation & Skills
	Telecomms	Dept for Business, Innovation & Skills
Emergency Services	Ambulance	Dept of Health
	Coastguard	Dept for Transport
	Fire & Rescue	Dept for Communities & Local Govt
	Police	Home Office
Energy	Electricity	Dept of Energy & Climate Change
	Gas	Dept of Energy & Climate Change

[268] https://ec.europa.eu/energy/sites/ener/files/documents/MEMO-14-593_EN.pdf

	Oil	Dept of Energy & Climate Change
Finance		HM Treasury
Food		Dept for Environment, Food & Rural Affairs
Government		Cabinet Office
Hazardous sites		Dept for Business, Innovation & Skills
Health		Dept of Health
Nuclear		Dept of Energy & Climate Change

Transport	Aviation	Dept for Transport
	Ports	Dept for Transport
	Rail	Dept for Transport
	Road	Dept for Transport
Water		Dept for Environment, Food & Rural Affairs

Appendix 6.2 – HMRC figures on exports and imports

Commodity	Imports (£ bn)	Exports (£bn)
All	**39.6**	**18.8**
Vegetables & fruit	6	1.7
Meat & meat preparations	5.2	6.5
Beverages	5.2	6.5
Cereals & cereal production	3.3	1.9
Coffee, tea, cocoa, spices	2.9	1.2
Dairy products & eggs	2.9	1.2
Miscellaneous edible products	2.8	1.6
Fish	2.7	1.6
Feeding stuff for animals (excluding unmilled cereals)	2	0.9

Oilseeds, oils, fats	1.7	0.6
Sugars, sugar preparations & honey	1.3	0.4

Appendix 6.3 – Additional references to official reports

The following tracks the official paper-trail tracking the development of UK policy subsequent to the Foresight report:

- The 2011 publication of a Government White Paper on the Natural Environment which, inter alia, promised further consultation between government, industry and environmental partners on how to reconcile the goals of improving the environment while increasing food production.
- Department for Environment, Food, and Rural Affairs, *Green Food Project Conclusions*, July 2012
- Department for Environment, Food, and Rural Affairs, *Sustainable Consumption Report: Follow-Up to the Green Food Project*, July 2013
- Environment, Food and Rural Affairs Committee, Second Report of Session 2014–15, *Food Security*, HC 243
- House of Commons Environment, Food and Rural Affairs Committee: Food security: demand, consumption and waste (Sixth Report of Session 2014–15) published 22 January 2015 as HC 703

Other activities contributing to the debate are:

- Biotechnology and Biological Sciences Research Council - £250 million strategic investment in UK bioscience, announced May 2012
- Technology Strategy Board Sustainable Agriculture and Food Innovation Platform https://connect.innovateuk.org/web/sustainable-agriculture-and-food-innovation-platform
- Global Food Security programme - see http://www.foodsecurity.ac.uk

7. Country Report – Canada

Anna Ekström and Stephanie Young

CRISMART, Swedish Defence University

7.1 Overview

In Canada, responsibility for strengthening the resiliency of critical infrastructure is shared among federal, provincial and territorial governments, local authorities and critical infrastructure owners and operators. The federal government fulfils national responsibilities relating to emergency management, including critical infrastructure, under the Emergency Management Act (EMA).

The following federal departments and agencies work with supply chains for food, drinking water, energy and pharmaceuticals and are discussed in this country report:

1. Agriculture and Agri-Food Canada (Minister of Agriculture and Agri-Food)
2. Environment Canada (Minister of the Environment)
3. Health Canada (Minister of Health)
    - Public Health Agency of Canada
4. National Defence (Minister of National Defence)
    - Department of National Defence
5. Natural Resources Canada (Minister of Natural Resources)
6. Public Safety Canada (Minister of Public Safety)

7.1.1 Public Safety Canada

Public Safety Canada was formed 2003 and is responsible for public safety. Legislation for the agency began in 2001 and the department was created in 2003. Originally under the Department of National Defence, the Office of Critical Infrastructure Protection and Emergency Preparedness (OCIPEP) was moved to the public safety and emergency preparedness portfolio in order to improve and strengthen the country's emergency preparedness and response to natural disasters and security emergencies. The office provides national leadership to help ensure the protection of Canada's critical infrastructure in both its physical and cyber dimensions, regardless of the source of threats and

vulnerabilities. OCIPEP is also the government's primary agency for ensuring national civil emergency preparedness.[269]

It became legally established when the Department of Public Safety and Emergency Preparedness came into force in 2005. The *Department of Public Safety and Emergency Preparedness Act 2005* and the *Emergency Management Act 2007* set out three fundamental roles for the Department:

1. support the Minister's responsibility for all matters related to public safety and emergency management, except those assigned to another federal minister,
2. exercise national leadership for national security and emergency preparedness; and
3. coordinate the efforts of Public Safety Portfolio agencies, as well as provide guidance on their strategic priorities. [270] [271]

"The Department's mandate spans from public safety and security, intelligence and national security functions, social interventions for youth-at-risk, to readiness for all manner of emergencies. The Department is called to rapidly respond to emerging threats and ensure the safety and security of Canadians" [272]

Public Safety Canada works to safeguard the critical infrastructure, based on three key objectives:

1. build trusted and sustainable partnership in CI
2. implement an all-hazards risk management approach
3. advance timely sharing and protection of information among partners

Public Safety Canada Regional Offices help support partnerships with critical infrastructure stakeholders through their work at the local level. The regional offices build and support relationships with critical infrastructure partners at the local level as well as with regional cross-border stakeholders.

In addition to the department there are five agencies within the Public Safety portfolio headed by the Minister of Public Safety:

1. Canada Border Service
2. Royal Canadian Mounted Police

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[269] CIRC, 2015
[270] Public Safety Canada, 28 August 2015
[271] The department is in many ways similar to the U.S. Department of Homeland Security (but it does not cover the protection of maritime sovereignty).
[272] Public Safety Canada, 28 August 2015

3. Canadian Security Intelligence Service
4. Correctional Service Canada
5. National Police Board

7.1.2 The National Strategies

The National Strategy for Critical Infrastructure and the supporting Action Plan for Critical Infrastructure were announced on May 28, 2010. Together, they established a collaborative federal, provincial, territorial and critical infrastructure sector approach to strengthening critical infrastructure resilience.[273] The National Strategy recognized that the responsibility for the critical infrastructure in Canada is shared between the actors on the levels mentioned above. The National Strategy as well as the Emergency Management Framework for Canada pointed out these responsibilities more in detail. National-level sector networks were established for each of the ten critical infrastructure sectors, with a lead federal department/agency responsible for each network: Health, Food, Finance, Water, Information and Communication Technology, Safety, Energy and Utilities, Manufacturing, Government, and Transportation. In addition, a National Cross Sector Forum was established to promote collaboration across sector networks, address interdependencies, and promote information sharing across sectors.

Figure 1: Canada's National Cross-sector Forum (Public Safety Canada, 2014)

[273] Public Safety Canada, 2014

For the purpose of this study the sectors "Energy and Utilities," "Health," "Food," and "Water" are relevant. In the case of energy and utilities, it is Natural Resources Canada who is the lead agency. Regarding health, it is the Public Health Agency of Canada and in the case of food it is the Agriculture and Agri-food Canada who is responsible. Finally, Environment Canada is the lead agency for the water sector.

7.1.3 Framework

The Canadian framework for emergency management takes a risk-based, all-hazard approach and is subject to revise every five years by the Federal, Provincial and Territorial (FPT) governments. Focus is also on community resilience in the sense that empowering citizens, responders, communities, and other significant actors to "share the responsibility to keep hazards from becoming disasters."[274] Emergency management responsibilities in Canada are shared by FPT governments and their partners, including individual citizens who have a responsibility to be prepared for disasters and contribute to community resiliency. Provincial and territorial governments have responsibility for emergency management within their respective jurisdictions. The federal government exercises leadership at the national level relating to emergency management responsibilities in its exclusive fields of jurisdictions and on lands and properties under federal responsibility. [275]

The Emergency Management Framework for Canada together with The National Strategy for Critical Infrastructure and Action Plan and the National Emergency Response System form the framework for the strategic work in Canada. The National Strategy states that responsibilities for critical infrastructure in Canada are shared by federal, provincial and territorial governments, local authorities, and critical infrastructure owners and operators – who bear the primary responsibility for protecting their assets and services. In addition, it is stated that "individual Canadians also have a responsibility to be prepared for a disruption and to ensure that they and their families are ready to cope for at least the first 72 hours of an emergency" [276].This means that individuals should be prepared with canned and ready-to-eat food and drinking water to cover their basic needs for at least 3 days as well as have two weeks of medication and medical supplies at their disposal.[277]

Recognizing the interconnected nature of critical infrastructure, the Canada-United States Action Plan for Critical Infrastructure (2010) established a coordinated, cross-border approach based on Canada's National Strategy and Action Plan and the United States' National Infrastructure Protection Plan[278],

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[274]Public Safety Canada, January 2011
[275] Public Safety Canada, January 2011
[276] Public Safety Canada, 2014: p.2-3
[277] Public Safety Canada, 2012: p. 9
[278] Public Safety Canada, 2014: p.3

"Building Resilience Against Terrorism: Canada's Counter-Terrorism Strategy" was released in 2012 and outlines the government's overall approach to protecting Canada and Canadian interests from acts of terror. In 2013 the government released the "Public report on the terrorist threat to Canada" [279]which focused on the implications of terrorism and what it can mean for Canadian citizens.

7.1.4 Partnership

All Canadians are involved in emergency management. Individual citizens, communities; municipalities; federal, provincial, territorial governments; Aboriginal peoples; emergency first responders; the private sector (both business and industry); volunteer and non-governmental organizations; academia as well as international organizations and allies may be involved in emergency management. The Cyber Security Strategy, released in 2010, also commits the government to engage public-private actors in a collaborative effort to enhance the cyber security, which in turn has implications for the protection of critical infrastructure.

The renewed action plan will build on the previous action plan to deepen existing partnerships and raising awareness of the need for collaborative action on critical infrastructure resilience. The renewed plan is ongoing and will be carried out during two years. To enable partnership with private actors, information sharing is a vital component and it is also one of the major topics that is expanded upon in the renewed action plan[280]. Key actions for this strategic objective are for example:

- Expand stakeholder membership and participation on the Canadian critical infrastructure gateway and leverage the CI gateway's capabilities so improve information sharing and collaboration on specific objects: the membership should span the ten sectors involved and other key stakeholders
- Promote to share information and best practices
- Sponsor security clearances among private stakeholders in order to enable increased sharing of sensitive information.
- Provide impact assessments during unfolding events of national significance: alerting critical infrastructure stakeholders to potential cross-sectoral effects so they can take appropriate response measures.

[279] Public Safety Canada, 15 May 2015
[280] Public Safety Canada, 2014

Public Safety Canada will also implement the all-hazard risk management approach to enable greater prioritization of activities and resources. [281]

Canada is committed to a number of international arrangements to enable collaborative science and technology work in support of shared public safety and national security priorities.[282] In the context of this report, there are two significant cooperation agreements in this area:

- **Canada - U.S. Agreement for Cooperation in S&T for Critical Infrastructure Protection and Border Security (CIPABS) -** CIPABS is a government-to-government agreement administered by DRDC and the Department of Homeland Security's Science and Technology Branch, which enables federal departments and agencies to establish collaborative arrangements for joint activities and information sharing between the two countries, including the transfer of funds and the exchange of personnel. Current collaboration includes activities related to chemical, biological, radiological and nuclear detection and defense, transportation security, interoperability, risk assessment, border security and surveillance, and critical infrastructure protection.
- **Canada-Sweden Implementing Arrangement on Cooperation in Public Security and Safety Science and Technology -** The Implementing Arrangement (IA) on Cooperation in Public Security and Safety Science and Technology is jointly administered by Defence Research and Development Canada's Centre for Security Science (DRDC CSS) and the Swedish Civil Contingencies Agency (MSB). The arrangement enables DRDC CSS to collaborate with Sweden's MSB and share experiences and lessons learned in areas of mutual interest to both countries, including but not limited to, community resilience, national risk-assessments, cyber security, critical infrastructure, extreme space weather, crisis communication and social media.

7.2 Energy

7.2.1 Overview – current situation and upcoming trends

Canada has one of the most diverse mix of energy sources in the world, reducing its dependence on single commodities and thus increasing its resilience to price and supply shocks. Canada has extensive hydrocarbon resources and is a large energy producer and exporter. It is the only country in the world with a growing oil production. [283] The addition of about 175 billion

[281] For more information on all strategic objectives, action items and time plan, see: Public Safety Canada, 2014: p. 13
[282] Defence R&D Canada – CSS, 2015
[283] Canadian Intergovernmental Conference Secretariat, 2015

barrels of reserves from Canada's oil sands means a major improvement for global crude oil reserves, and production from these reserves means Canada is also more self-sufficient, providing a larger share of its own resources than many other countries. Oil, natural gas, nuclear and hydroelectric are all a part of the diversity of energy sources.

Many countries view the primary goal of energy security to be securing a reliable supply. In the case of Canada, a country rich in energy sources, energy security is a much more complex concept.[284] Mining, oil and gas pipelines, global shipping, hydroelectric dams, and the electrical grid are all components of the complex mechanisms upon which Canadian energy depends. In the event of a disruption in supply, substitution to other energy sources is often extremely difficult because of the large, fixed nature of these systems.

The population is growing, and so is the demand. Therefore more energy will be required to meet the basic needs of Canadians. Today, wind is the largest contributor (generating 1% of Canada's electricity) to the renewable energy sector. Geothermal and solar energy play a negligible role in meeting the energy needs.

Despite being a net energy exporter, Canada relies on imports for nearly half its domestic oil consumption, in part because of its primarily north-south pipeline network. Of those imports, over half come from OPEC nations. It is cheaper for the eastern provinces to import from OPEC nations than shipping western oil across the country Canada's dependency upon foreign oil production implies the constant potential for politically motivated disruptions of supply. Understanding the role of both geopolitics and state control over resources is therefore integral to understanding energy security. [285] As in the case of oil and natural gas, geographic and economic factors mean that while western provinces export and consume their own coal, Ontario, Nova Scotia and New Brunswick are reliant on coal imports[286].

In Canada, government control over oil resources is minimal. Canada has a free energy market and does not have a large state-owned oil company, a rarity among petroleum-rich nations. Because market supply and price are volatile and sensitive to geopolitical factors, the reliance of Canada on oil import means that the country is as vulnerable to destabilizing market effects of global events as any other state.[287]

Canada ranks second in global production of hydroelectricity. Canada is also the second largest global producer and exporter of uranium. It has the world's third largest oil reserves and is the third largest exporter of natural gas.

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[284] Capstone, July 2010: p. 20
[285] Ibid.
[286] Ibid.: p. 8
[287] Capstone, July 2010

[288]Canada is also well positioned to generate energy from other renewable sources such as wind, solar, geothermal, marine, and biomass.

The northern parts of the country are rich areas which are relatively untapped, and provide good possibilities for development.

7.2.2 Structural, organizational and legislative foundation

Chapter 4 of Canada's National Security Policy highlights the importance of infrastructure security.[289] In service of this policy, the Department of Public Safety and Emergency Preparedness created a National Strategy for Critical Infrastructure, which outlines the strategy and action plan for the federal government to address this issue.

The plan identifies 10 sectors of critical infrastructure, one of which is energy and utilities. Each sector is assigned to a government department that organizes a sector network with partners in the private sector. In the case of the energy sector, this network has been organized under the auspices of Natural Resources Canada, and includes representatives from the private sector and various government departments who play a role in infrastructure protection.

Natural Resources Canada (NRCan) has taken a leading role in the government's efforts to build closer relationships with the private sector. Through its Energy Infrastructure Protection Division (EIPD), the department works as a liaison between the owners and operators of infrastructure, relevant government departments and international partners such as the United States and Mexico to promote and facilitate communication and cooperation between them. [290]

As the portfolio department for many of the agencies and organizations involved in infrastructure security, the Department of Public Safety and Emergency Preparedness plays an important coordinating role for the various government agencies contributing to infrastructure security. This extends beyond the energy sector to include the various interdependencies that exist between different types of infrastructure, such as telecommunications, transport, and health. Finally, other government organizations, such as the National Energy Board and the Canadian Nuclear Safety Commission, provide the regulatory regimes.

In Canada, the state does not intervene in the energy sector. This was not always the case. Government intervention in the market used as a tool to achieve energy security in Canada with the creation of the National Energy Program (NEP). During the 70s, Ottawa attempted to alter what had become a natural flow of energy from north to south, to an east-west orientation so

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[288] Canadian Intergovernmental Conference Secretariat, 2015
[289] Fraser Institute, 28 May 2013
[290] National Resources Canada, NRCAN: http://www.nrcan.gc.ca/home

Western Canadian oil could supply eastern Canadian markets at a stable and affordable price. The program also aimed to increase Canadian ownership and control of the energy sector.

The NEP was a failure, due to different factors, and the program was repealed in 1985. Energy companies then lobbed to expand interdependence between the US and Canada through increased oil exports and the creation of the Canada-U.S. Free Trade Agreement (FTA) and its successor, the North American Free Trade Agreement (NAFTA) was created. NAFTA significantly reduced the governments' efforts to assert political control over the energy sector.

7.2.3 Key stakeholders, partnerships and networks and their interests

The OECD states that "the risk that sovereign immunity could shield anti-competitive conduct might be factored into the decision under national competition law to clear or block a merger or acquisition." Reacting to this reality, Petro-Canada and Suncor merged in 2009, creating the country's largest energy company and providing the oil patch with protection against potential foreign buyouts.

Moreover, foreign financial influence in Canada could be limited by the Investment Canada Act (Part IV.1, Investments Injurious to National Security). This act allows the Canadian government to review foreign investment that could be harmful to national security. Under this part of the Act, if national security threats associated with investments in Canada by non-Canadians are identified by Canada's security and intelligence agencies, they will be brought to the attention of the Minister of Industry.[291]

The enormous fixed cost of required infrastructure promotes the emergence of a natural monopoly in the energy sector. Because of vertical mergers, the infrastructure for the production, distribution and transportation of energy in Canada is strongly controlled by upstream and downstream actors. Therefore, the energy market in Canada is partially closed to the emergence of new suppliers or investors, which then affects energy security by reducing the diversification of energy sources.

The US and Canada have highly integrated electricity grids, and supply almost all of each other's electricity imports. The electricity trade between the provinces and their neighboring US states exceeds interprovincial transfers. Canada and the US also share an extensive oil and gas pipeline network. Canada is the largest individual supplier of oil to the United States; most of Western Canadian production is exported south.

[291] Capstone, July 2010

7.2.4 Community, private and individual initiatives

Due to the fact that much of energy supply chains are privately owned, there are already attempts to include the private sector in the government's efforts to secure these supply chains. The combination of the energy infrastructure's scale and Canada's free market energy sector has led to an increasing necessity for partnership and cooperation between private-sector owners and operators and those government agencies concerned with infrastructure maintenance and security.

Responsibility for energy intensity and efficiency issues falls to the Office of Energy Efficiency (OEE), part of Natural Resources Canada. The OEE administers programs aimed at educating Canadians about the need for conservation, as well as initiatives that provide incentives to individual citizens to make their homes more energy efficient. While these individual programs are helpful with respect to enabling individual Canadians to decrease their energy intensity, there is no coherent national strategy in Canada that addresses high levels of energy intensity.

7.2.5 Current, planned and proposed measures, policies and strategies

Efforts are made to diversify and expand the natural resources markets through strengthened pipelines, offshore and nuclear safety legislation and making the review process for major resource projects more predictable.

Responsibility for the security of the infrastructure is divided among multiple government and private actors, and Canada's National Strategy for Critical Infrastructure has proposed collaboration between these various actors.[292] As the primary operator of energy infrastructure, the private sector plays a central role in its protection, particularly against natural and accidental threats. However, this situation is changing rapidly as the private sector takes on a greater role in the prevention of human-made threats, typically working in conjunction with government agencies. [293]

A number of recent initiatives and innovations are meant to foster a sense of trust and build working relationships between the private sector and the government. These have included information and intelligence sharing programs (e.g., security clearances for certain private-sector employees), as well as the sharing of technical expertise to improve threat assessments and analysis.[294]

Private-sector employees are increasingly being encouraged to take an active role in infrastructure security, with the Royal Canadian Mounted Police

[292] Canada Public Safety, 2015
[293] Capstone, July 2010: p. 20
[294] Capstone, July 2010: p. 20

establishing a dedicated tip-line and information campaign, aimed at increasing energy-sector worker awareness of potential threats to infrastructure.

Canada's energy security is much dependent on market conditions and the development of necessary infrastructure to bring the oil to international markets, including pipeline infrastructure from Alberta to US and to Asian markets via the Northern Gateway pipeline to Canada's west coast. Both of the projects remain in limbo and TransCanada is looking into an energy east pipeline running to a refinery center in New Brunswick. This shows that diversification is also important for energy producers and not only consumers.

There is currently a shift from oil and gas resources to other resources such as oil sands, shale gas, and renewable fuels. The energy sector is focusing on new technology for alternatives and energy efficiency, and electricity systems are integrating increased volumes of cleaner fuels, including natural gas, nuclear, hydro (large-scale and small-scale), and other renewable sources.[295]

7.2.6 Potential vulnerabilities, threats and risks

The size of Canada with its cold climate and low population density and a lot of energy used for space heating and travel make its risk measures of energy intensity and energy use per capita (especially in the transportation sector) above the OECD average.

Approximately 75% of the energy Canadians consume comes from fossil fuels [296], which are finite resources. While Canada will not face resource shortages in the short term because of its resource endowments, population growth and rising consumption levels will continue. Therefore there is a need for development of other sources of energy.

Oil makes up the largest single share of Canada's energy mix. The second largest fossil energy input is natural gas, where Russia plays a main role. In North America, Canada imports natural gas from the United States, which is regarded as a reliable partner.[297] Consequently natural gas is less of a security issue in Canada than in Europe.

Another major challenge is the aging energy infrastructure. There is a lack of structural investment in energy infrastructure in Canada, which poses a risk to the procurement and affordability of energy.

[295] Canadian Intergovernmental Conference Secretariat, 2015
[296] World Bank, 9 September 2015
[297] Capstone, July 2010

7.2.7 Strategies for reducing dependency on certain resources

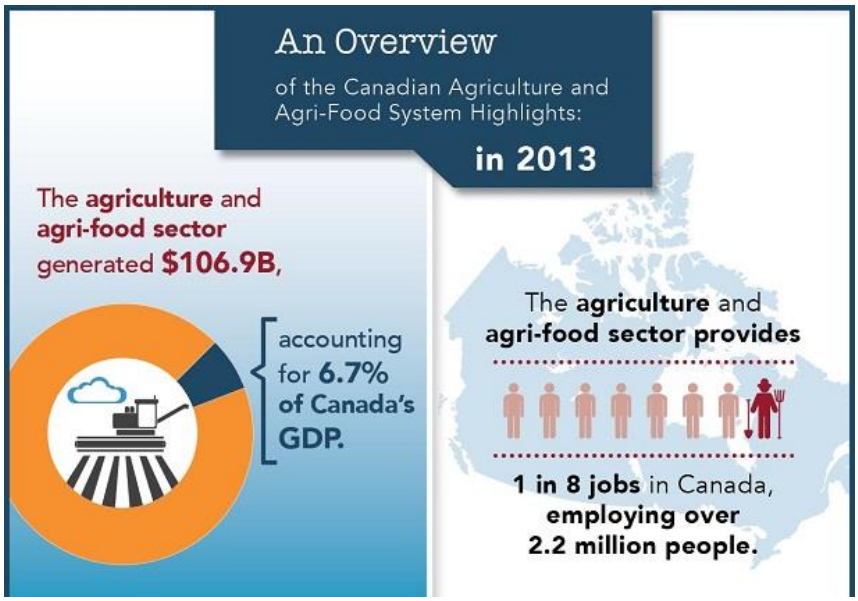
One major topic in Canada is market diversification with leaders emphasizing the need to look beyond the United States as a market for its energy products[298]. After the United States failed to allow the construction of the Keystone XL Pipeline in 2012, Prime Minister Harper told a US audience that "we cannot be in a situation where really our one and only energy partner can say no onto our energy products". [299]

Because of the fact Canadian reserves of coal are abundant, there are low constraints on its production and its efficacy as a fuel or even the issue of exporting it. Coal is common in electrical generation, providing roughly two thirds of the electricity of Alberta, Saskatchewan and Nova Scotia. However, environmental concerns are increasingly shaping the discussion around coal.

7.3 Food Supply Chain

7.3.1 Overview – Current situation and upcoming trends

The agricultural sector in Canada is not only important in terms of feeding its population but it provides employment opportunities and is significant to the country's economy. In 2013, the Canadian agriculture and agri-food system (AAFS) generated nearly $107 billion, accounting for almost 7% of the country's GDP and responsible for providing one in eight jobs.[300] Of the AAFS, the foodservice industry is the largest employer. See figure below. [301]



[298]Fraser institute, 28 May 2013: p. 2
[299] Ibid.
[300] AAFS, 17 April 2015
[301] Ibid.

Canada is one of the largest agricultural producers and exporters in the world.[302] In spite of the fact that the proportion of the population and GDP devoted to agriculture fell dramatically during the 20th century, agriculture remains an important part of the Canadian economy. The U.S. imports about 50% of Canadian agricultural goods, and supplies Canada with 61% of its imports.[303] The main exported products include "non-durum wheat, canola, crude canola oil, frozen pork, refined canola oil, durum wheat, and beef"; the majority of the exports are unprocessed commodities.[304] According to the AAFC[305] "approximately half of the value of primary agriculture production in Canada is exported, as either as primary commodities or processed food and beverage products" with the processed food industry significantly growing. According to the Department of Agriculture and Agri-Food Canada (AFFC), in just the past 3 years, exports to the U.S. have increased 10% and 6% to other countries.[306] Yet simultaneously, operating costs have increased 40% during the time period 2003 to 2013 due to larger expenses for commercial seed, fertilizer and lime, machinery fuel, and labor costs.[307]

Canada imports fruits, vegetables, and grains from the U.S., the EU, Mexico, China, Brazil, and Thailand. Yet most of these are imported as processed goods in the form of juices, beer and wine, baked goods, pasta, chocolate and sugar confectionaries, and boneless/prepared meat.[308]

Table 1: Canadian Agri-Food Trade in CDN$ million[309]

	2012	2013	2014
Domestic Agri-Food Exports:	43,570.283	46,012.427	51,532.902
Agri-Food Imports	33,110.975	35,264.606	39,445.691

[302] ACT, 3 July 2013: 38
[303] Ibid.; AAFC, 13 April 2015: 10
[304] ACT, 3 July 2013: 40
[305] AAFC, 13 April 2015: 10
[306] AAFC, 13 April 2015: 10-11
[307] Ibid: 11
[308] ACT, 3 July 2013: 40-41
[309] AAFC, 11 March 2015

	2012	2013	2014
Agri-Food Trade Balance	10,459.308	10,747.820	12,087.211

In different parts of Canada, farms, fisheries and ranches produce a wide variety of crops, livestock, food, feed, fuel, and other valuable goods. In effect, the Canadian prairies are one of the most important global producers of wheat, canola, and other grains.[310]

Agriculture in Canada is comprised of five main agricultural production sectors, including:

- Grains and oilseeds (wheat, durum, oats, barley, rye, flax seed, canola, soybeans, rice, and corn) - 34% (domestic and export)
- Red meats – livestock (beef cattle, hogs, veal, and lamb) - 24% (domestic and export)
- Dairy - 12% (domestic)
- Horticulture - 9% (domestic)
- Poultry and eggs - 8% (domestic)

The AAFC publishes an annual report describing the current status and trends in the Canadian agriculture and agri-food system. Here, the AAFS is regarded as extremely important to the Canadian economy:

> "The Canadian agriculture and agri-food system is a complex and integrated supply chain which includes input and service suppliers, primary producers, food and beverage processors, food retailers and wholesalers, and foodservice providers. The activities along this supply chain generate significant economic benefits at both the federal and provincial levels."[311]

"Canada's food distribution sector represents the final link in the food supply chain from food producers and processors to consumers. It is a large and complex sector that includes supermarkets, grocery stores, restaurants and fast food operations, as well as the wholesalers, distributors and brokers that supply them. There are about 24 thousand retail stores and close to 63 thousand foodservice establishments in Canada, with total consumer sales of $131 billion

[310] Britton, 1996
[311] AAFC, 13 April 2015

in 2005. The sector employed 1.4 million people and accounted for 4% of Canada's total Gross Domestic Product."[312]

Canada's emphasis on securing its food supply chain appears to be closely tied to its agricultural export activities. For example, when the Canadian Agricultural Policy Institute (CAPI) and its partners discussed the security of the country's food supply, the issue of exports was raised. The group recommended three concrete targets, the so-called "75 by 25" targets.[313]

1. Exports: Doubling the dollar value of Canadian agri-food exports to $75 billion, up from $38.8 billion.
2. Domestic consumption: Produce and supply 75% of our own food, up from 68%.
3. Bio-materials/fuels**:** Generate revenue and efficiency by relying on biomaterials and biofuels in 75% of the agri-food sector.

7.3.2 Structural, Organization and Legislative Foundation

Agriculture in Canada is a shared jurisdiction between Federal/Provincial/Territorial (FPT) governments. The Department of Agriculture and Agri-Food, also referred to as Agriculture and Agri-Food Canada (AAFC) or Ag-Canada, is the department responsible for policies governing agriculture production, farming income, research and development, inspection, and the regulation of animals and plants as well as rural development.[314] Together with the AAFC, Health Canada and the Canadian Food Inspection Agency have complementary roles in developing, enforcing and interpreting policies and guidance based on the Food and Drugs Act and Regulations.

- **"Health Canada** develops policies, regulations and standards related to the health, nutritional and safety aspects of foods governed under the Act and Regulations. It also develops guidance documents to assist industry in compliance.
- The **Canadian Food Inspection Agency** enforces the Food and Drugs Act and the associated requirements established by Health Canada as they relate to food safety and nutritional quality. It maintains the *Guide to Food Labelling and Advertising*, a tool to help industry, consumers and inspectors interpret food policies and regulations.

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[312] AAFC, 13 May 2015

[313] CAPI, February 2011: 91

[314] Government of Canada, 2015

- **Agriculture and Agri-Food Canada** provides information and guidance to industry groups on food policy and regulatory issues.

The three federal departments communicate regularly to ensure that regulations and policies are developed in a way that supports industry investment, innovation and competitiveness"[315] as well as promote and protect public safety and health.

The House of Commons Standing Committee on Agriculture and Agri-Food serves the task of reviewing and studying the policies and programs within the agriculture and agri-food portfolio, including those of the AAFC and its agencies[316] as well as overseeing the Canadian Food Inspection Agency, the Canadian Wheat Board and the Pest Management Regulatory Agency even though they are not included in the agriculture and agri-food portfolio.

In recent years there has been criticism and claims that there is an unnecessary amount of red tape in government activities and that there are policy silos (lack of knowledge what the other authorities are doing and consequently overlaps and gaps). This has triggered, among other things, a push for streamlining regulatory organizations and stronger cooperation between authorities.[317]

Table 2: Alignment of 2015–16 Planned Spending with the Whole-of-Government Framework[318]

Strategic Outcome	Program	Spending Area	Government of Canada Outcome	2015–16 Planned Spending (CAD)
Strategic Outcome 1: A competitive and market-oriented agriculture, agri-food and agri-based products sector that proactively manages risk	1.1 Business Risk Management	Economic Affairs	Strong Economic Growth	1,301,429,496
	1.2 Market Access, Negotiations, Sector Competitiveness, and Assurance Systems	Economic Affairs	Strong Economic Growth	194,586,263

[315] AAFC, 21 February 2015
[316] The Canadian Grain Commission, the Farm Products Council of Canada, the Canadian Dairy Commission, and the Farm Credit Canada.
[317] CAPI, pgs 83-87
[318] AAFC, 31 March 2015

Strategic Outcome	Program	Spending Area	Government of Canada Outcome	2015–16 Planned Spending (CAD)
	1.3 Farm Products Council of Canada	Economic Affairs	A Fair and Secure Marketplace	3,028,779
Strategic Outcome 2: An innovative and sustainable agriculture, agri-food and agri-based products sector	2.1 Science, Innovation, Adoption and Sustainability	Economic Affairs	An Innovative and Knowledge-based Economy	537,550,506
	2.2 Industry Capacity	Economic Affairs	Strong Economic Growth	70,990,651
	2.3 Canadian Pari-Mutuel Agency	Economic Affairs	A Fair and Secure Marketplace	0

In July 2008, the FPT Ministers of Agriculture created a multilateral agricultural framework, Growing Forward (GF). GF replaced the Agricultural Policy Framework, which was criticized for providing limited FPT coordination of agricultural policies and consequently resulting in excessive government expenditures.[319] GF committed $1.3 billion to a five year framework for non-business risk management programs and the costs for these programs were shared between the federal government (60%) and the provincial and territorial governments (40%).[320]

GF was considered a success and therefore the framework was extended an additional five years (2013-2018) with the establishment of Growing Forward 2 (GF2). GF2 serves as the policy framework for Canada's agricultural and agri-food sector. The GF2 framework was outlined in the Saint Andrews Statement (SAS) and it aims to help industry position itself to meet the challenges of 2020

[319] AAFC, 23 November 2011
[320] ACT, 3 July 2013: 7

and beyond. The vision, intent, principles, policy outcomes and common policy directions for a common agricultural policy framework were outlined in the SAS, which provided the foundation for GF2.[321]

[321] AAFC, 23 November 2011

The GF2 framework has identified two important targets for the agricultural sector:

1. Competitiveness in domestic and international markets
2. Adaptability and sustainability for the sector [322]

The federal, provincial and territorial governments have invested three billion dollars in GF2, and it serves as a foundation for government agricultural programs and services.[323] These programs and services focus on innovation, competitiveness and market development in order to ensure that Canadian producers and processors have the tools and resources they need to deal with emerging market opportunities, which in turn will improve supply chains.[324]

In March 2012, the Standing Committee on Agriculture and Agri-Food commenced a study on the food supply chain. After getting an overview of the food supply chain, the Standing Committee focused its research on issues related to the supply chain of three specific sectors: red meat, grains and oilseeds, and beverages. [325]

In the study, the red meat industry is identified as the largest sector of the Canadian food manufacturing industry. Over the past years "there has been a great deal of consolidation in the supply chain, resulting in fewer stakeholders and larger companies, in order to gain efficiencies."[326] Food is collected from a wide region then transported by rail to handling and processing facilities. For example, grain travels an average of 1400 kilometers from the farm to a port where it is then shipped overseas. Moving large volumes of food over long distances is a key element in the supply chain in Canada. The federal government is involved and regulates the supply chain in various ways, including grading, quality assurance, food safety, and railway safety.

Meat processing and many other agricultural activities are carried out by either very large or very small companies, both of which have very different approaches and face different challenges. Basically the mid-sized producers and sellers have been eliminated. The large companies require large handling facilities and transportation services (primarily rail) for very long distances. A backlash to the trend of consolidation has been the emergence of small local suppliers. The number of smaller local companies has increased since consumers are increasingly considered about the environment, animal welfare, food safety, and personal health.

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[322] Ibid.

[323] AAFC, 24 July 2015

[324] Ibid.

[325] Standing Committee on Agriculture and Agri-food, June 2013

[326] Ibid.

In Canada there are many different players in the agri-food sector and the conditions and playing ground are constantly changing.[327] Consequently, this has resulted in a highly fragmented consumer market and the industry is being pulled in many new directions.[328]

In some links of the food supply chain there appears to be signs of a shortage trained and skilled agricultural workers (for example, in meat-processing, livestock transportation, and slaughtering) since fewer people today have farming backgrounds and these jobs are no longer attractive. This development can create a weak link in the supply chain. If there are too few skilled workers then domestic food production could decrease and the country would then have to rely on external sources. Already today, Canada sends live cattle to the U.S. to be slaughtered and then Canada buys back the processed meat. In some regards, this may be cheaper than domestic solutions since Canada is a very large country and distances are large. Sending food to the U.S. to be processed may require significantly less transportation than sending it to the other side of the country. Nevertheless, these types of solutions require transnational actions and subsequently harmonizing regulations and rules as well as conforming to the terms asserted by another country.

In an attempt to strengthen competitiveness and profitability of the Canadian agriculture and agri-food sector, Value Chain Roundtables (VCRTs)[329] were launched in 2003. These roundtables brought together key players from the entire value chain (input suppliers, producers, processors, food service industries, retailers, traders and associations) as well as federal and provincial governments, providing a forum for discussing commons concerns and developing common strategies.[330]

The Canadian Agricultural Policy Institute (CAPI) published the report "Canada's Agri-Food Destination - A New Strategic Approach" (2011) which discussed the key issues and future concerns for Canada's agri-food sector: unprofitability of the sector, a national shift toward greater imports and diminished exports, unsustainable health care costs, and environmental concerns. Recommendations were proposed, including longer sectoral planning of up to 15 years, specific planning targets, greater emphasis on agri-food systems planning rather than fragmented segments or value chains, and integrated agri-food, health, and environment policies (ACT, 3 July 2013: 52).

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[327] Standing Committee on Agriculture and Agri-food, June 2013

[328] Ibid.

[329] Eleven national value chain roundtables were established: beef, food processing, grains, horticulture, organic, pork, pulse industry, seafood, seeds, sheep, and special crops.

[330] Standing Committee on Agriculture and Agri-food, June 2013

7.3.3 Key stakeholders, partnerships, and networks

Bilateral trade agreements with the U.S. as well as harmonized agricultural and economic regulations and policies are important for supporting Canada's food supply chain since there is a great deal of food supplies crossing the U.S. – Canadian border. The US and Canada work closely on several animal health and agricultural issues, including tracking cattle herds for diseases (e.g., Mad Cow disease in the early 2000s).

The United States has traditionally and will remain a priority market for Canada; however, diversifying markets internationally will enable Canadian producers and processors to capitalize on new opportunities.

Canada is a member of NATO and NAFTA. Both of these organizations influence how Canada works with food supply chains.

7.3.4 Strategies

In the National Strategy for Critical Infrastructure, food is identified as one of the ten sectors of critical infrastructure, each of which is assigned to a government department that organizes a sector network with partners in the private sector. In the case of the food sector, this network has been organized under the auspices of Agriculture and Agri-food Canada and includes representatives from the private sector and various government departments who play a role in infrastructure protection. These networks were created in order to foster an atmosphere of coordination and cooperation and to encourage all participants to share information and expertise in order to improve infrastructure security.

In accordance with the National Strategy for Critical Infrastructure, emphasis is put on cross-sectoral partnerships and early engagement in all phases, activities, and plans in order to enable common priorities and improve information sharing.

7.3.5 Priorities

Canada is heavily dependent upon global economic growth for maintaining and supporting its domestic food supplies. Therefore major long-term priorities include being able to compete on the international market by maintaining productivity, keeping down production costs, maintaining an active and skilled work force, and long-term sustainability as well as a regulatory system that is competitive with Canada's major trading partners.[331]). If revenues from agriculture exports significantly decline, Canada may be forced to cut spending

[331] CAPI, February 2011: 85

or limit investments in agriculture;[332] thus, weakening domestic food supply chains.

Transportation is crucial for the domestic market as well as for exports. Consequently, it is crucial that investments are made in the transportation infrastructure (in particular rail).

7.3.6 Risks

Climate change scenarios for 2050 suggest that due to increased precipitation and temperatures the growing season will be longer.[333] Not all plant and animals specifies will benefit from this change and some may not be able to adapt independently or quickly enough to these changes. Likewise, soil quality can also be significantly affected by climate changes. Certain crops and forests could be at higher risk of fire, pests and drought.[334] Fisheries could also be negatively affected by climate change since some specifies are sensitive to water temperatures.

In an attempt to address these issues, stakeholders and key groups from government, industry and professional organizations have been brought together under the umbrella of the Adaptation Platform**.** This platform provides a forum for exchanging knowledge, capacity and financial resources. The Climate Change Impacts and Adaptation Division (CCIAD) at the National Resources Canada leads the Adaptation Platform.[335]

There are a number of conflicting interests which could result in increased vulnerability:

- Domestic food needs vs economic gains via exports
- Large companies vs smaller local producers and sellers
- Market for exports and exchange rate and remaining internationally competitive
- Sufficient number of trained and skilled agricultural workers
- New market opportunities for agricultural products (grains being used for biofuel instead of feed)
- Transportation over long distances

[332] AAFC, 31 March 2015
[333] Natural Resources Canada, 13 August 2015
[334] Ibid.
[335] Natural Resources Canada, April 2014

7.4 Water

Canada has over 31,000 large lakes, more than any other country, containing much of the world's fresh water.[336] In addition, it has several fresh-water glaciers as well. In short, Canada has an abundance of fresh water."[337]

Climate warming and global annual precipitation scenarios for 2050 suggest that precipitation will increase over land and ocean, but will not be disturbed evenly. In general, increases in temperatures will result in increased evaporation and consequently more precipitation.[338] The increase in water will have a significant impact on properties located near smaller rivers and urban areas. There are concerns that water quality could be negatively affected by the sudden increase in the amount of water.[339]

7.4.1 Structural, organizational and legislative foundation

Responsibility for environmental/water management in Canada is a shared responsibility between the FPT governments. Each level of government has different roles related to the water management but there are many areas of shared jurisdiction. Many of the provincial governments delegate some authority to the municipalities, in particular drinking water treatment and distribution, waste-water treatment operations, and sometimes even responsibility for a particular water basin.[340] The federal government is responsible for managing water on federal lands and federal facilities.

Environment Canada (Department of the Environment) is responsible for coordinating environmental policies and programs as well as preserving and enhancing the natural environment and renewable resources, including water, air, soil, flora and fauna. The department is governed by the Minister of the Environment in accordance with the Department of the Environment Act.[341]

Freshwater quality monitoring is a core program function of Environment Canada. These activities are critical for assessing and reporting on water quality status and trends, and for fulfilling many federal domestic and international commitments and legislative obligations. Much of this monitoring is carried out through FPT agreements.[342]

Within the federal government, there are over 20 departments and agencies with some sort of responsibility for fresh water that are involved in creating

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[336] Bailey, Oke, and Rouse, 1997
[337] Natural Resources Canada, 13 August 2015
[338] Ibid.
[339] Natural Resources Canada, 13 August 2015
[340] Environment Canada, 2015: 1
[341] Wikipedia, 7 September 2015
[342] Environment Canada, 2015: 5

and upholding water management and regulatory policies. A central challenge is to ensure that these are developed and managed collaboratively. “Environment Canada works closely with other federal departments to develop a more strategic approach to addressing nationally significant freshwater issues.”[343]

The framework for water management cooperation was stipulated in the 1970 Canada Water Act, and the 1999 Canadian Environmental Protection Act added the issue of protection of water resources to the existing framework. Federal legislation, the 2000 Water Act, "supports and promotes the conservation and management of water, including the wise allocation and use of water.”[344] The provinces are responsible for administering the Water Act (2000) as well as implement and oversee the regulation of municipal drinking water, wastewater, and storm drainage systems. The environmental ministries of the individual provinces often lead various water management programs.[345]

Federal and provincial governments have jointly developed and implemented basin-wide action plans to ensure access to clean, safe and healthy water, and that water resources are wisely managed and sustainably used in collaboration with communities and other stakeholders. Environment Canada’s Ecosystem Initiatives are local activities coordinated by Environment Canada and implemented by a range of local partners and stakeholders (public authorities, private businesses, NGOs, community organizations, and higher education establishments).[346]

The Water Survey of Canada is the scientific branch of Environment Canada. It is responsible for collecting, analyzing and disseminating data on the country’s water resources. This information is used to identify reliable supplies of good quality water and assess hydro power and irrigation potential as well as protect Canada's sovereignty over its water resources. [347]

7.4.2 Legislation

When it comes to water governance in Canada, the federal government has jurisdiction related to fisheries, navigation, federal lands, and international relations, including responsibilities related to the management of boundary waters shared with the United States and relations with the International Joint Commission. It also has significant responsibilities for agriculture, health and the environment, and plays a significant role supporting aquatic research and

[343] Environment Canada, 7 September 2015

[344] Environment Canada, 3 September 2010

[345] Government of Canada, 7 September 2015

[346] Environment Canada, 2015:18-19

[347] Environment Canada, 8 July 2013

technology, and ensuring national policies and standards are in place on environmental and health-related issues.[348]

Significant water legislation administered by Environment Canada includes:

- Canada Water Act - contains provisions for formal consultation and agreements with the provinces
- International River Improvements Act - provides for licensing of activities that may alter the flow of rivers flowing into the United States
- Department of the Environment Act - assigns the national leadership for water management to the Minister of the Environment.

In 1987, the Federal Water Policy was formulated. It addresses the management of water resources, the issue of water usage, and consideration for the environment. Its overall objective is "to encourage the use of freshwater in an efficient and equitable manner consistent with the social, economic and environmental needs of present and future generation."[349]

> "Provincial legislative powers governing water management issues include, but are not restricted to, areas of: [350]
>
> - flow regulation
> - authorization of water use development
> - water supply
> - pollution control
> - thermal and hydroelectric power development"
>
> "Canadian governments have created institutions to focus on specific water issues that have implications for more than one province or territory. For example, the Prairie Provinces Water Board manages an agreement for the equitable apportionment of eastward-flowing prairie rivers and the consideration of water quality problems.
>
> The Federation of Canadian Municipalities (a non-governmental organization) effectively represents municipalities' interests. Among its many activities are efforts to identify water issues and best practices that municipalities are encouraged to take into account in their

[348] Environment Canada, 3 September 2010
[349] Government of Canada, 28 May 2015
[350] Environment Canada, 9 September 2013

> "All jurisdictions in Canada are actively addressing challenges related to aging or inadequate drinking water and wastewater treatment infrastructure. The federal, provincial, and territorial governments have established funding programs that support collaboration with municipalities in improving the quality of infrastructure, with funding for water and wastewater and water supply utilities as a significant focus of these programs. Similar large-scale investments are addressing the need for improved water and wastewater treatment facilities to meet the health and environmental needs of First Nations and Inuit communities."[351]

7.4.3 Partnerships

While providing national leadership to ensure that Canada's freshwater management is in the national interest, Environment Canada also actively promotes a partnership approach among the various levels of government and private sector interests that contribute to and benefit from the wise management and sustainable use of the resource.[352]

7.4.4 Strategies

Water is identified as one sector of the critical infrastructure in the National Strategy for Critical Infrastructure. Consequently, the federal government has outlined general strategies and action plans for these sectors, which focus on cross-sectoral collaboration at all levels in all activities, creating common priorities as well as sharing information and expertise. Environment Canada has the role of maintaining a sector network for issues addressing the water supply chain with public and private stakeholders.

In addition, Public Safety Canada and the Canadian Water and Wastewater Association have started joint efforts to identify measures that can be taken to assist in strengthening the resilience of Canada's water sector.

7.4.5 Potential risks and vulnerabilities

Although there is still quite a bit if uncertainty regarding when, how and to what degree climate change will affect water supply chains in Canada, and elsewhere, there are a number of key considerations that should be taken into account: [353]

- increase in the magnitude of water due increased precipitation, snow melting, and spring runoff

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[351] Ibid.

[352] Environment Canada, 9 September 2010

[353] Environment Canada, 3 August 2010

- evapotranspiration would be greater, as it would start earlier and continue longer; and
- the interior continental region in the Northern Hemisphere will, in general, experience drier summers.
- damage to wetlands which serve to filter water of sediments and toxic substances thus improving water quality**.**

This means that the geographic location and magnitude of water will change. This will have implications for water treatment plants as well as for irrigation possibilities, which in turn will affect drinking water and food supply chains.[354]

7.5 Pharmaceuticals

Canada is today relying more on pharmaceuticals for treating illnesses and diseases.[355] In turn, this makes Canada more vulnerable to disruptions in pharmaceutical supply disruptions. Consequently, drug pricing and purchasing strategies of pharmaceuticals in Canada are high on the political agenda. Much of the current work on addressing disruptions and shortages in the pharmaceutical supply chain draw upon cooperation and information strategies between the different stakeholders at different levels.

7.5.1 Structural, organizational, and legislative foundation

Health Canada is the government department with responsibility for national public health, under which the Public Health Agency of Canada has specific responsible, for among other issues, pharmaceuticals.

Canada has a universal publicly funded health care system, although it is the only country with a universal healthcare system that does not cover prescription drugs. This means most Canadians pay directly for these or rely on employment-based private insurance. Provinces hold responsibility for social programs including health care. The federal government cannot force the provinces to adhere to certain national policies. Rather the federal government can initiate national policies in the provinces and encourage participation by providing funding or other resources (e.g., Canada Health Act[356]). In most cases the majority of provinces participate.

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354 Ibid.

355 FPT Ministerial Task Force on the National Pharmaceuticals Strategy, June 2006:21-22

356 The Canada Health Act is “an Act relating to cash contributions by Canada and relating to criteria and conditions in respect of insured health services and extended health care services” (Government of Canada, 1985).

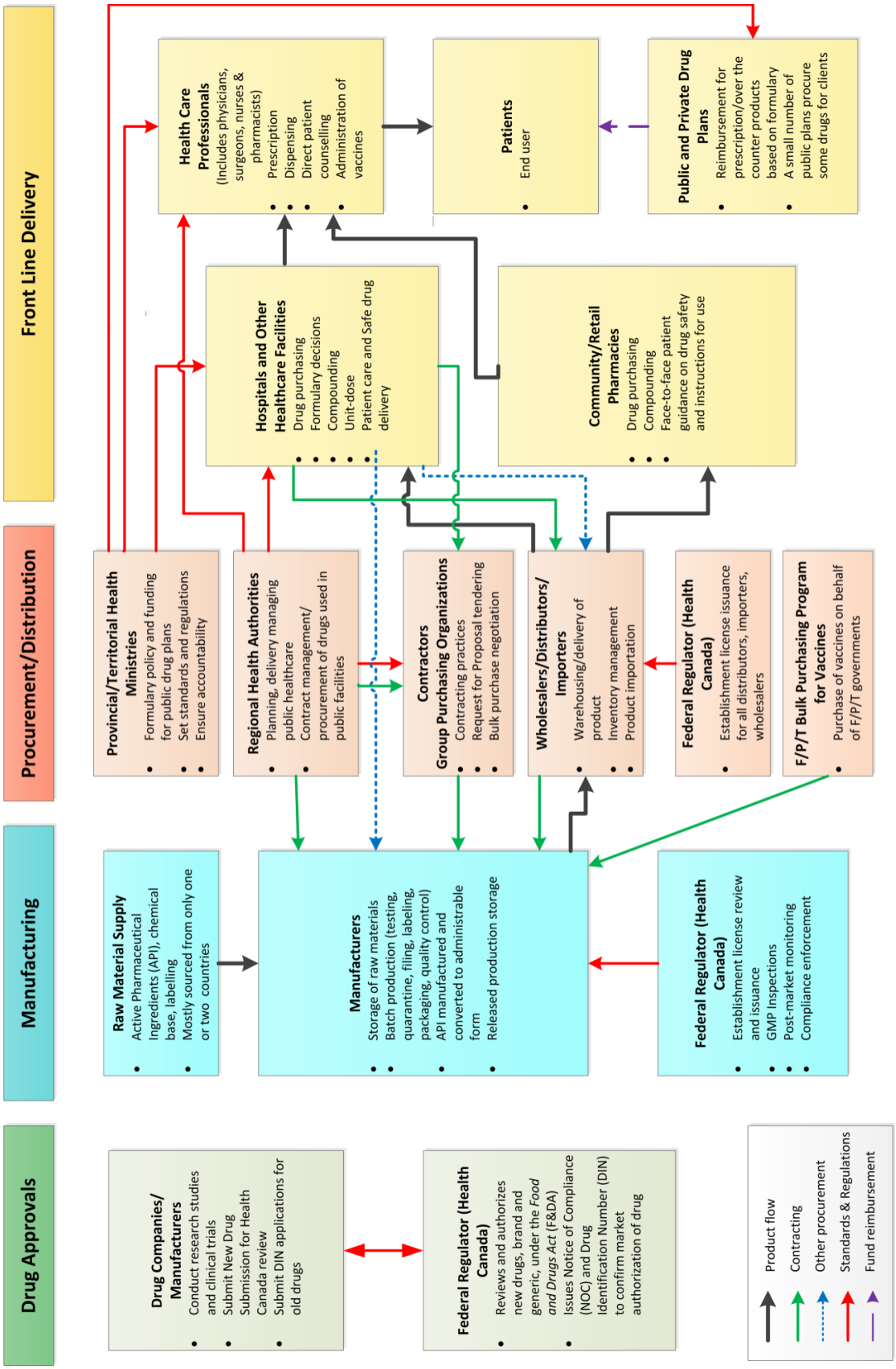
The pharmaceutical sector in Canada is characterized by multiple government jurisdictions, public health care providers, private insurers, employers, brand and generic industries, patients, and advocacy groups.[357]

7.5.2 Key stakeholders, partnerships, networks, and individuals

In 2012, the Multi-Stakeholder Steering Committee on Drug Shortages (MSSC) was established in order to discuss and address the issue of drug supply chain with representatives of industry associations, federal, provincial and territorial governments, and health professional associations.[358]

[357] FPT Ministerial Task Force on the National Pharmaceuticals Strategy, June 2006:26

[358] Multi-Stakeholder Steering Committee on Drug Shortages in Canada, 2013



Source: Multi-Stakeholder Steering Committee on Drug Shortages in Canada, 2013:7

In 2013, the steering committee published a Multi-Stakeholder Toolkit that describes the Canadian drug supply chain (i.e., chemical pharmaceuticals, biologic drugs and vaccines). The toolkit also clarifies the roles and responsibilities of the key players and presents tools and strategies for addressing shortages or disruptions in the supply chain.[359] In the toolkit, the drug supply chain in Canada is divided into four stages: [360]

- Drug approval – Health Canada. Health Canada serves as the country's drug regulator and therefore authorizes clinic trials of new drugs; reviews results and data on drug safety, effectiveness, and quality; and permits manufacturers to market drugs in the country
- Manufacturing – pharmaceutical production (fabricators, packagers/labellers, and testers).
- Procurement/distribution – ordering, purchasing and delivering of drug products (wholesalers, distributors and importers)
- Front-line delivery – delivery to patients (hospitals, pharmacies, and other health care facilities).

Manufacturers are required to report actual and anticipated drug shortages as well as discontinuations and make this information publicly available.[361] "There are a number of horizontal committees and working groups assembled to collaboratively address drug shortages in Canada. At all levels of the supply chain, inter-disciplinary teams actively collaborate to prepare for and react to drug shortages. For example, many hospitals have drug shortage groups comprised of pharmacists, physicians, and nurses to ensure the most efficient and effective responses on the ground.

At a more national level, there are three collaborative groups working to advance drug shortage mitigation, management and communication strategies. Each is briefly described below.[362]

- **Multi-Stakeholder Working Group** is made up of industry and health professional associations. The Working Group is responsible for the creation and management of *www.drugshortages.ca*. Funding for the website is provided directly through Rx&D and CGPA. Through this website, the Working Group has contributed to the improved notification of drug shortages in Canada. Further, the group has committed to enhance the site by adding clinical information on

[359] Ibid.

[360] Ibid.; pgs. 3-6

[361] Government of Canada, 10 February 2015

[362] Multi-Stakeholder Steering Committee on Drug Shortages in Canada, 2013:21-22

therapeutic alternatives and notification of product discontinuations six months in advance.

- **Provincial/Territorial Drug Shortage Task Team** was created by the P/T Deputy Ministers of Health in March 2012 in response to the Sandoz supply disruption. Chaired by Alberta Health and comprised of representatives from all provinces and territories, regional health authorities, and group purchasing organizations, the Task Team communicates broad reaching shortages between jurisdictions and has been useful in identifying, tracking and responding to critical and emerging shortages. The Task Team is shifting focus to a longer-term strategic perspective and greater attention to shortages in community settings.
- **Multi-Stakeholder Steering Committee on Drug Shortages (MSSC) -** As noted in the Foreword, the MSSC was struck in August 2012. The Committee is co-chaired by Alberta Health and Health Canada and includes a number of industry and healthcare organizations from manufacturing, distribution and front line delivery. MSSC objectives include drug shortage prevention and mitigation, crisis management and resolution, and building knowledge and sharing information."

7.5.3 Strategies

Within the National Strategy for Critical Infrastructure, pharmaceuticals are included in the health sector. Consequently, the federal overarching strategies and action plan (cross-sectoral cooperation on all levels, common priorities, and information sharing) apply here as well.

In terms of information sharing, this directly applies to collecting information about current and potential pharmaceutical shortages via regular communication with the various stakeholders and the creation of a data base. This information is used to make trend assessments. Likewise, different stakeholders in different phases of the supply chain have dedicated staff to monitor and manage drug shortages.

"In Canada veterinary drugs are not always available in a timely fashion due to the delay in approval process. The Committee recognizes there needs to be greater harmonization and a better recognition of scientific evidence produced in other countries. But the Committee also acknowledges that companies have their own business decisions about the markets they want their products to be approved in." [363]

[363] Standing Committee on Agriculture and Agri-Food, 7 March 2012: 1540

Health Products and Food Branch (HPFB) Strategic Plan 2017-2012 supported the strategies of modernizing Canada's regulatory frameworks for health products and food as well as put great emphasis on strengthening international cooperation in order to harmonize international standards and technical requirements and support capacity building capacities in countries with developing regulatory systems.[364] These strategies stress again the emphasis Canada puts on international trade.

Manufacturers can help mitigate some of these consequences by making arrangements with back-up suppliers and holding a reserve supply of products at higher risk of shortage. Under certain circumstances, Health Canada may approve the sale of drugs not licensed in Canada in order to ease the effects of a shortage.[365]

Group Purchasing Organizations can pull together so that they have more purchasing power and receive higher priority from suppliers and manufacturers. Also these groups can be used to manage shortages within their network.

Other strategies include applying alternative therapies and repackaging products in different dosages/concentrations and even changing how the medicine is administered (oral via intravenous).

Most vaccine supply stakeholders have contract stipulating requirements for mandatory inventory stockpiles and obligations that manufacturers increase supplies in the event of a disruption from other suppliers.[366]

7.5.4 Potential risks and vulnerabilities

Many of the drug shortages arise in the manufacturing stage. The majority of manufacturers in Canada use single foreign suppliers for raw materials and many of the manufacturers use the same supplier. In turn this creates dependency on one or few suppliers, which are often located outside of Canada. This introduces vulnerability to the overall supply chain when the sole supplier delays or halts production. Thus there is little possibility to influence the conditions in another country, and consequently a natural disaster or political unrest in another part of the world can result in a lack of pharmaceuticals in Canada.[367] Furthermore, there is global trend witnessing a decrease in the number of manufacturers due to corporate mergers, discontinuation of non-profitable products, downsizing product portfolios, and introduction of new products. Other delays and shortages can be caused by inconsistencies in international regulatory requirements.

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[364] Health Canada, 26 July 2012

[365] Multi-Stakeholder Steering Committee on Drug Shortages in Canada, 2013: 17

[366] Ibid.: 19

[367] Ibid.: 15

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8. Country Report – the U.S.

Robert L. Bach

Multinational Resilience Policy Group

8.1 Overview

8.1.1 The Security and Resilience of Supply Chains

During the last few decades, two major trends merged to elevate the significance of supply chain security and resilience to the top tier of US national security priorities. As the world's largest economy, long-term increases in the efficiencies of transportation, information technology, energy extraction and use, and cyber connectivity transformed US international and domestic supply chains. Movement toward "just-in-time" production and delivery reduced the number of alternate suppliers and fine-tuned inventories in ways that reduced the costs and need to hold redundant capacities. Supply chains tightened, becoming increasingly integrated as each activity and participant throughout the network became more dependent on each other.

Over the same period, supply chains became increasingly exposed to disruptive risks. Some of the risks emerged from the same transformations that fueled the significant economic gains. Intensified pursuit of natural resources, for instance, increased supply chain risks in at least three ways: (1) exploration into more remote areas of the world with politically unstable regimes; (2) dependence on very low wage labor that generated human rights violations; and, (3) encroachment into environmentally sensitive areas that raised the likelihood of ecological dangers. With supply chains organized more for productivity and efficiency than safety or security, extreme weather also became a major hazard. One estimate indicated that in 2011 damages to private supply chains from extreme weather cost companies an additional 38 percent of annual expenditures to respond and recover from them.[368]

US national security strategy has long recognized this central risk tradeoff between the economic efficiencies of modern supply chains and their corresponding exposure to disruption from natural disasters and manmade threats. For most recurring risks, US strategy relies on the capacity of private companies, which are best placed and equipped to handle their own problems, to support supply chain security and resilience. However, the terrorist attacks of 2001 and the catastrophic consequences of Hurricane Katrina in 2005,

[368] Zurich Financial Services Group and Business Continuity Institute (2011)., News Release, Zurich, November 30, 2011. https://www.zurich.com/en/media/news-releases/2011/2011-1130-01; Bolgar, Catherine, "Wal-Mart: A Model of Efficiency in an Emergency Situation," http://online.wsj.com/ad/article/accenture2.html, 2007.

among other precedent-setting emergencies in the last two decades, demonstrated how terrorist-driven and natural disaster-induced disruptions to global and domestic supply chains could affect the security and well-being of the entire nation. Strong public sector intervention was necessary to build national capabilities to prepare, protect, mitigate, respond and recover from these catastrophic possibilities.

Even in the immediate aftermath of the 9/11/01 attacks, US national security strategy focused on the fundamental risk tradeoff: How to foster simultaneously the economic efficiencies of supply chains while strengthening their security and resilience.[369] The 9/11/01 attacks directly hit the nation's critical infrastructure and the supply chains that support it. They slowed transportation networks to a halt and, even though trade and other forms of mobility recovered in only a few days, the threats launched a new security regime that continues to raise the costs of transportation-linked supply chains and to slow their performance. Finding strategies to increase security, while reducing costs, drives the objectives of current and future supply chain policies.

Hurricane Katrina, Superstorm Sandy and the more recent Ebola crisis are additional precedent setting disasters that shaped and transformed US security and resilience strategies. Looking back, supply chains adjusted much faster than expected to all three emergencies. Global trade through the Port of New Orleans, for instance, quickly diverted to other ports even as Hurricane Katrina approached the coast. Electricity grids adjusted to Superstorm Sandy in the Northeast as regional networks reached and shared across jurisdictional boundaries. Even gasoline supplies, which were seriously disrupted during the storm, and food supplies, which caused the greatest concern, adapted relatively quickly to potential shortages. Yet, US national leaders subsequently acknowledged that the potential for even greater catastrophic disruptions called for a new framework for supply chain protection. In 2012, the National Strategy for Global Supply Chain Security identified as a primary risk the potential for "localized disruptions [to] escalate rapidly and impact U.S. interests and the broader global community."[370]

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[369] Former Secretary of State, Condoleeza Rice explained, "Our terrorist adversaries seek not only to kill innocent civilians, but they have also targeted our economic infrastructure with the goal of reducing our capacity and will to continue to the fight. Since over 90% of global trade in goods is transported in containers through the maritime supply chain, ports and related infrastructure are an inviting target." Thomas Lehrman, "Remarks at Maritime Security Expo," September 27, 2006. U.S. Department of State. Bureau of Public Affairs, Preventing Weapons of Mass Destruction (WMD) Terrorism in the Maritime Supply Chain, http://www.state.gov.

[370] The White House, National Strategy for Global Supply Chain Security. Jan 2012. https://www.whitehouse.gov/sites/default/files/national_strategy_for_global_supply_chain_security.pdf

8.1.2 The National Strategy Framework

Presidential Policy Directive #2, issued only months after the 9/11 attacks, highlighted the priority of critical infrastructure and supply chains to the Nation's security and resilience. Title II of the Homeland Security Act of 2002 detailed how the newly created Department of Homeland Security (DHS) would carry the responsibility for critical infrastructure. Congress charged DHS with developing a comprehensive framework to protect the Nation's critical infrastructure generally and its supply chains in particular. Recognizing the need to adapt to future changes, Congress required recurring updates to overall and sector-specific plans (e.g., the National Infrastructure Protection Plan, 2006, 2009, and 2013).

A crucial principle of this comprehensive framework fully embraced the federalist structure of the US government and the Nation's dependence on the private sector that owned and operated over eighty percent of critical assets. The core of the National Strategy was to build and maintain a joint public-private partnership that recognized the independent array of 56 US states and territories, all tribal jurisdictions, and the full range of private owners and operators. The goal of this complex partnership, with overlapping jurisdictional authorities and ownership rights, was to foster extensive participation and collaboration in setting priorities, targeting investments, and implementing programs that supported critical infrastructure and supply chain security and resilience.

The value proposition underlying the joint public-private partnership was straightforward: Broad-based engagement and collaboration from diverse and decentralized participants would enable public-private councils, designed around 16 critical infrastructure sectors, to jointly identify and rank risks, partner with others to decide on priority investments, gain access to actionable, timely threat information from the government, and coordinate assets and responses during and after an emergency.

8.1.3 Partnership Governance

The national infrastructure partnership operates under the Critical Infrastructure Partnership Advisory Council (CIPAC), an umbrella organization that includes representation from public-private councils representing each critical infrastructure sector.[371] Each Council facilitates a range of coordinating

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[371] US Department of Homeland Security, "Charter of the Critical Infrastructure Partnership Advisory Council (CIPAC)," The National Infrastructure Protection Plan, 2013. https://www.dhs.gov/xlibrary/assets/cipac/cipac_charter.pdf; http://www.dhs.gov/sites/default/files/publications/National-Infrastructure-Protection-Plan-2013-508.pdf; US Department of Homeland Security, "A Guide to Critical Infrastructure and Key Resources Protection at the State, Regional, Local, Tribal, and Territorial Level," September 2008, http://www.dhs.gov/xlibrary/assets/nipp_srtltt_guide.pdf

structures that include a Sector Coordinating Council (SCC), which is a self-organized, self-governed group of private sector key stakeholders, and a public sector counterpart, the Government Coordinating Council (GCC).[372] For each sector there is also a Federal department or agency that operates under Presidential Policy Directive PPD-21 to provide the institutional knowledge and specialized expertise to support the range of activities of both the SCCs and the GCCs.

The US National Strategy also specifically embraces partnerships that coordinate regionally across state, territorial and tribal boundaries, and that foster international collaboration. In 2008, for instance, DHS organized a Regional Consortium Coordinating Council that enabled it to coordinate with regional coalitions involved in federal and state level program activities. International efforts to strengthen crossborder, global supply chains were also a clear priority. Programs included the United States-Canada Beyond the Border Initiative, the 21st Century Border Management Initiative with Mexico, and several activities coordinated with the European Union.

The National Strategy also recognized that, even in the midst of a disaster with sweeping national implications, most critical infrastructure security and resilience activities, including preparedness, protection, mitigation, response and recovery, occur at a regional, state and, especially, local community level. These are the locations and the jurisdictions in which private owners and operators have direct authority and can deploy their resources. Local nongovernmental organizations and individual citizens also are able to take immediate steps to secure critical infrastructures. Small businesses, for example, which are often the key to quick recovery from a disaster, depend on local finances, local consumers, and local supporters. This "whole community" philosophy became a hallmark of the US National Strategy to promote security and resilience.[373]

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[372] US Department of Homeland Security, National Infrastructure Protection Plan 2013: Partnering for Critical Infrastructure Security and Resilience, January 2014, http://www.dhs.gov/sites/default/files/publications/NIPP%202013_Partnering%20for%20Critical%20Infrastructure%20Security%20and%20Resilience_508_0.pdf http://www.dhs.gov/critical-infrastructure-partnership-advisory-council. http://www.dhs.gov/sites/default/files/publications/cipac-charter-12-07-14-508.pdf

[373] FEMA, "A Whole Community Approach to Emergency Management: Principles, Themes, and Pathways for Action." Washington, DC: FEMA. 2011. http://www.fema.gov/about/wholecommunity.shtm; Kaufman, David, Robert Bach, and Jorge Riquelme, "Engaging the Whole Community in the United States. Chapter 5, pp. 151-185 in Bach, Robert, Strategies for Supporting Community Resilience. Multinational Experiences. CRISMART, Volume 41. Stockholm, 2015.

8.1.4 Implementation of The National Strategy for Global Supply Chain Security[374]

The priorities attached to various critical infrastructure sectors result from a continuous series of risk assessments. The Strategic National Risk Assessment (SNRA) evaluates the risks of known threats and hazards to the nation as a whole. Supported by the Director of National Intelligence and the Attorney General, the Federal interagency Assessment supports the government-wide, integrated planning system that informs overall homeland security preparedness and resilience.[375]

The Office of the Director of National Intelligence also coordinates an Intelligence Community Assessment of threats to the global supply chain system. The Assessment, completed in December 2012, represents the first-ever US Government assessment of the range of threats that could trigger national or network-level disruptions to the supply chain system and impact US interests domestically and abroad. The Assessment is distinct from other risk analyses because it goes beyond threats associated with specific critical infrastructure sectors (such as manufacturing, transportation, energy, banking and finance, etc.) to consider the supply chain system as an integrated entity.

Each of the 16 Sector Coordinating Councils also examines the risks associated with its own particular interests and conditions. Each Sector Plan, updated every three or four years, identifies and ranks sector-specific risks and, through its public-private partnerships, recommends priority programs and investments.

8.1.5 Future Challenges

The future security and resilience of US supply chains face a distinctive challenge. With such a large and dynamic private sector, forward-looking US government initiatives must stay aligned with the performance and transformation of the private economy. For instance, current upheaval in the national and international energy sector is rapidly transforming the calculation of security risks for both the medium and long-term. Traditional energy supply exploration will continue to create possibilities for disruptions that resemble the environmental tragedies in the Arctic from the Exxon Valdez accident and the more recent British Petroleum incident in the Caribbean. Yet, the rapid emergence of new forms of oil and gas extraction – so-called fracking – also

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374 National Strategy for Global Supply Chain Security Implementation Update January 2013 https://www.whitehouse.gov/sites/default/files/docs/national_strategy_for_global_supply_chain_security_implementation_update_public_version_final2-26-131.pdf

375 U.S. Department of Homeland Security, Strategic National Risk Assessment, December 2011, http://www.dhs.gov/xlibrary/assets/rma-strategic-national-risk assessment-ppd8.pdf

creates exposure to unanticipated and unprecented disruptions. In just a few years, for example, the fracking industry has reshaped transportation systems throughout the US, transformed supply chain partners, and led to several catastrophic accidents that have killed hundreds and destroyed entire communities.

The future challenge for US security and resilience strategies will continue to be a struggle between the central tensions embedded in supply chains: supply chain efficiency and productivity vs. risk reduction, security and resilience. US national strategies must be able to adapt quickly to support the economic opportunities that will open with deployment of new technologies and shifting supply chains, while expanding the security of these uncertain ventures.[376] To be successful, US strategies must promote a closely integrated partnership between all levels of government, the private sector and the whole community.[377]

An example of this future strategic thrust involves the search among private companies for ways to reduce risks in supply chains by limiting the amount and scale of complexity in the system as a whole. Reducing complexity creates greater control over supply chains and leads to both economic advantages and greater security. Private sector leaders report that they are searching for ways to redesign supply chains to contain risks and to prevent them from spreading. One redesign principle includes segmentation of supply chain to create gaps or barriers to potential cascading consequences from disruptions. Functional segmentation would subsequently lead to regionalization of supply chain activities. Cutting through these redesign principles is an effort to create "smart supply chains," which could be supported by both private and public sector initiatives. Smart supply chains use new technologies to digitize activities throughout the supply network and rely on the monitoring and analytical techniques of "big data" to coordinate and assess potential risks. These smart chains support increased productivity and through greater real-time awareness and continuous analysis could strengthen both the security and resilience of the entire supply network.

The four critical infrastructure sectors of interest in this Report are particularly vulnerable to disruption. Among pharmaceutical companies, for instance, the stability of drug distribution along global supply chains is a continuous economic advantage and a primary reason why large multinational companies

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[376] Sunil Chopra and ManMohan S. Sodhi, "Reducing the Risk of Supply Chain Disruptions," MITSloan Management Review, Spring 2014. http://sloanreview.mit.edu/article/managing-risk-to-avoid-supplychain-breakdown/.

[377] Shillingford, David, "Improving Supply Chain Visibility," Risk Management, May 1, 2015. http://www.rmmagazine.com/2015/05/01/improving-supply-chain-visibility/; Widmer, Lori, "The Hidden Risks of Outscouring, May 1, 2015. http://www.rmmagazine.com/2015/05/01/the-hidden-risks-of-outsourcing/

seek to control their own networks. During emergencies, however, disruption of normal distribution networks may cause drug shortages and prevent timely and effective treatments. Food and water supply chains also face disruptions from severe drought and catastrophic storms. In these and other critical infrastructure sectors, the central question for US strategy is how the US government and private owners and operators will work together to design more efficient, more secure, and more resilient supply chains.

8.2 Food and Water Supply Chains

8.2.1 Overview – current situation and trends

The primary focus of the US government's involvement in food and water supply chains is to ensure public health. US strategy combines food supply chains with agriculture more generally to form one of the 16 critical infrastructure sectors established under the National Infrastructure Protection Plan ('the NIPP'). According to the NIPP, the Food and Agriculture Sector is defined as "the supply chains for feed, animals, and animal products; crop production and the supply chains of seed, fertilizer, and other necessary related materials; and the post-harvesting components of the food supply chain, from processing, production, and packaging through storage and distribution to retail sales, institutional food services, and restaurant or home consumption."[378] In general, the Sector involves diverse producers, distributors, manufacturers, retailers, service providers, and consumers that sequentially link raw material inputs with processing activities to distribute products to consumer markets.

Drinking water and wastewater management form a separate critical infrastructure sector that reflects both similar functions and a shared reliance on the authorities of state and local governments. Unlike food supply chains, which are primarily the responsibility of private companies, the US government at all levels has made enormous investments in the water infrastructure. Federal, state and local governmental authorities have supported investments in the dams, canals, levees, sewers, and wastewater treatment to promote public access to clean water. Much of this investment occurred in response to major emergencies that contaminated urban water supplies, including the Cuyahoga River fire of 1969 and the Love Canal contamination in the mid-1970s. These localized disasters led to broader, national efforts to improve water quality (e.g., The Clean Water Act of 1972, Drinking Water Act of 1974, the Superfund Act of 1980).

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[378] The White House, US National Strategy for Physical Protection of Critical Infrastructures and Key Assets, Washington, DC, February 2003, http://www.dhs.gov/xlibrary/assets/Physical_Strategy.pdf

8.2.2 Food Supply Chains

The US food and agriculture sector is vast. Farming and ranching, for example, account for over $1 trillion of national wealth, including nearly $60 billion in annual exports, and generate roughly 10 percent of the nation's jobs.[379] Food supply chain networks connect over 100,000 production and processing facilities located throughout the country, and countless facilities overseas in foreign countries that export foods and food products to the United States.[380] The resilience of these food supply chains is strongly dependent on the capacity of food production facilities worldwide, and disruptions in any of part of these global and domestic networks directly influences the availability of food to the consumer.

The extensive networks that comprise the global food chain contain myriad risks for US consumers. The Centers for Disease Control (CDC), for instance, estimates that contaminated food accounts for approximately 48 million illnesses in the US and costs more than $14 billion a year in medical care, lost productivity, and chronic health problems.[381] US agriculture and food production also offer tempting targets for violent extremists and terrorists. Recurring intelligence assessments indicate that terrorists have a sustained interest in poisoning the food supply and causing chaos throughout the supply chain. Increased costs, public panic and a public health crisis could be the consequence of a successful attack.[382]

Prevention, protection and mitigation of risks to the food supply chain depend on quality controls and emergency preparations throughout the supply chain. In general, however, agricultural industries do not maintain costly excess capacity to handle disruptions in production at the large poultry, pork or beef processing plants. For example, the US pork packing industry processes on average 480 million pigs a week. Any disruption in one of the large processing plants would significantly harm the quality and availability of meat throughout the US.[383]

While the agricultural system in the US adjusts well to generally recurring problems, it is often unprepared for large-scale, emergency surprises related to

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[379] US Department of Agriculture, Economic Research Service, Frequently Asked Questions, 2014. www.ers.usda.gov/faqs.

[380] Ibid., 2014.

[381] Centers for Disease Control, Estimates of Foodborne Illness in the United States, 2011. http://www.cdc.gov/Features/dsFoodborneEstimates/.

[382] FBI Law Enforcement Bulletin, Agroterrorism: Threats to America's Economy and Food Supply, 2012. http://leb.fbi.gov/2012/february/agroterrorism-threats-to-americas-economy-and-food-supply.

[383] Food and Water Watch, Factory Farm Nation 2015. Washington, DC. http://www.factoryfarmmap.org/wp-content/uploads/2015/05/FoodandWaterWatchFactoryFarmFinalReportNationMay2015.pdf

large storms or manmade disruptions. In early 2015, for instance, several U.S.-based companies suffered significant financial losses after their subsidiaries in China encountered widespread problems from poor quality control of their food supplies. One US-based company spent roughly a million and a half dollars to help establish an Asia Quality Control Center designed to monitor quality issues throughout their Asian plants.[384]

8.2.3 Water Supply Chain Risks

Water is clearly vital for the entire US economy. [385] During the last decade, widespread drought in the Southwest and Southeast stressed regional water systems to an extent that they sparked political and legal conflicts among neighboring states. Elsewhere, excessive use of the large aquifers in the Midwest and Florida is rapidly depleting accessible and high quality drinking water.

Yet, disruptions to the water supply chain are not always from climate or other natural changes. Labor disturbances among large farmers and food manufacturers, financial upheavals, and the more direct threats from hazardous spills cause supply chains to slow and break. Not all hazards, however, are acute emergencies. Long-term demographic trends also cause chronic pressures on water capacities. Mounting population density and increased agricultural and energy intensity, for example, expose entire communities to depletion and degradation of rivers, lakes and aquifers. The current, historic drought in California and much of the Southwest is testimony to the growing fragility of existing water supplies and the supply chains they support.[386]

Natural events, however, pose some of the most significant risks to both water and food supply chains. Floods, hurricanes, droughts, and earthquakes disrupt the quality and quantity of water supplies and, in turn, damage food production and distribution.[387] The US Department of Agriculture estimates, for instance, that the summer drought of 2012 damaged agricultural productivity across

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[384] Widmer, Lori, "The Hidden Risks of Outscouring, May 1, 2015. http://www.rmmagazine.com/2015/05/01/the-hidden-risks-of-outsourcing/.
[385] http://water.columbia.edu/research-themes/global-floods-initiative/managing-water-risks-through-the-supply-chain/
[386] US Environmental Protection Agency, National Water Program 2012 Strategy: Response to Climate Change, 2012. http://water.epa.gov/scitech/climatechange/2012-National-Water-Program-Strategy.cfm.
[387] See Haraguchi, Masahiko, and Upmanu Lall, Flood Risks and Impacts: Future Research Questions and Implications to Private Investment Decision-Making for Supply Chain Networks. Background Paper prepared for the Global Assessment Report on Disaster Risk Reduction 2013. Geneva, Switzerland: United Nations Office for Disaster Risk Reduction, 2013.

large areas of the Southeast, Midwest, Great Plains, and Southwest.[388] In the Mississippi River Basin, one-in-one-hundred year floods in 2011 were followed the very next year with an extended drought that brought commercial navigation on the River to a halt. Damages from the floods alone reached $5 billion, and the cost of slowing transportation up and down the River amounted to nearly $300 million a day.[389]

8.2.4 Governance of food and water supply chains

The US government strategy for the security and resilience of food and water supply chains is closely aligned with its overall public-private partnership model. Presidential Policy Directive 21 designates the Department of Agriculture and the Department of Health and Human Services as the lead agencies for food and water security and resilience.

Cooperation with State governments is especially critical in the water sector because nearly all permitting authorities for drinking water use depend on state laws. The Federal Environmental Protection Agencies also works closely with state agencies to implement many of their protection and resilience initiatives. Federal-state collaboration, however, also must contend with the uneven distribution of capabilities and resources across all 56 states and territories. Water management places a considerable burden on local and state government agencies that do not have the same level of expertise and economic resources as the Federal government. As a result, although regulatory efforts to control water pollution have improved surface and ground water quality overall, an uneven pattern of water contamination continues to subject communities to unsafe water. According to the Value of Water Survey, for example, nearly 67 percent of respondents reported that they had to boil their water at least once in the last year due to a disruption in supply.[390]

The Water and Wastewater Sector[391] is led by a partnership of diverse public and private drinking water and wastewater utilities, including investor, community or individually owned and operated. The sector partnership also includes national and state associations, state, local, and tribal governments, research foundations and Federal agencies. The US Environmental Protection Agency (EPA), which chairs The Water Government Coordinating Council

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[388] US Department of Agriculture, "USDA Expands Drought Assistance to 22 States." News Release No. 0300.12. September 2012. http://usda.gov/wps/portal/usda/usdahome?contentidonly=true&contentid=2012/09/0300.xml.
[389] Ibid., 2012.
[390] 2012 Value of Water Survey Index. Americans on the U.S. Water Crisis. Xylem Inc. http://www.xyleminc.com/valueofwater/ perhaps use the Value of Water Survey as reference.
[391] See WSCC Strategic Roadmap (nawc.org) http://www.nawc.org/uploads/documents-and-publications/documents/document_5582326a-7a35-4f67-923b-279c642b5129.pdf

(WGCC), holds legislated authorities to lead efforts to protect public health and environmental conditions. This legislation includes the Public Health Security and Bioterrorism Preparedness and Response Act of 2002 ('Bioterrorism Act'), which EPA with the authority to conduct vulnerability assessments and to develop emergency response plans with the partnership members.

The governance structure for the Food and Agriculture Sector is also shared between the US Department of Agriculture and the Department of Health and Human Services (DHHS). DHHS, in turn, delegates the responsibility to the Food and Drug Administration (FDA). The Department of Agriculture has responsibility for plant and animal health, including the safety of the Nation's supply of meat, poultry, and processed egg products. FDA is responsible for the safety of the food consumed in the US. It regulates over $400 billion worth of domestic food and nearly $50 billion worth of imported foods.

Within the Department of Homeland Security, the Office of Health Affairs supports the National Biosurveillance Integration Center (NBIC) that coordinates surveillance systems that search for biological events of national concern. It also supports other Federal government initiatives to protect the security of the Nation's water and food supplies, including the Department of Interior's WaterSMART initiative[392] and FoodSHIELD.

8.2.5 International Organizations and Foreign Countries

The US Federal government works closely with Canada and Mexico to secure the water systems that cross their international boundaries. International cooperation to protect food supply chains is very extensive, including sector initiatives on plant and animal health, food safety, and soil and water management. The US also participates in international standard-setting programs designed to manage risks associated with trade and movement of assets among its partners. These events include operational coordination with the World Health Organization to provide mandated notifications about the occurrences of animal and plant diseases and emerging infectious diseases.

8.2.6 Future Challenges

From a private sector perspective, future security and resilience of food and water supply chains raise a number of challenges. Although existing and anticipated technologies could improve water use efficiency and increase reliability and quality of water supplies, private sector leaders often report that the international-national-state-local governance regimes create confusing regulatory rules and authorities that impede innovation in supply chain infrastructure design. A 2013 survey of corporate leaders, for instance, reported that two-thirds of large companies that considered water risk part of their strategic horizon had water management as part of their direct

[392] http://water.usgs.gov/wsi/

operations, but only 4 percent had specific goals to manage water risks in their supply chain.[393]

The outlook, however, may be improving. Several large US-based multinational companies with huge water and food supply chain footprints are working on more effective risk management efforts to promote the security and resilience of clean water and safe food supplies. Just this year, the Coca-Cola company announced that it would achieve a 100 percent level of recycling of the water it used in its production and distribution activities. One of the largest US food producers, Cargill, also recently launched an effort to build a supply chain monitoring and assessment tool to help food and beverage customers gain visibility into their supply chain and to analyze its risks. The goal is to "plan for disruption" by providing companies with sufficient early warnings to mitigate supply dislocations due to an uncertain, all-hazards environment.[394]

8.3 Energy Supply Chains

8.3.1 Overview – current situation and trends

Energy supply chains are complex systems that begin with the extraction of raw materials, often in remote locations, and involve myriad products, services, transportation modes, labor supplies and, ultimately, consumers. Throughout the supply chain, these activities and the companies and organizations involved interact with and cross multiple jurisdictional boundaries. They also involve private sector owner and operator interests that generate competition and rivalry as much as collaboration. In part because of this complexity, in 2013 the President issued Presidential Directive 21 identifying these energy sector participants and their supply chains as uniquely critical to the security and resilience of the entire nation.

The US energy sector is changing rapidly and with it the restructuring of global and domestic supply chains. Just in recent years, the outlook for oil markets has gone from an apparent global shortage, which heightened US security interests in oil-producing regions, to a domestic surplus resulting largely from innovations in oil extraction methods. According to the International Energy Agency (IEA), North America has or soon will have the the world's largest reserves of unconventional oil and gas. By 2035, the new reserves will reach levels some 50 percent higher than total conventional stores in the Middle East.[395]

The security and resilience of US oil supply chains will face different risks as new technologies compete with older forms of production and distribution.

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[393] https://www.cdp.net/CDPResults/CDPGlobal-Water-Report-2013.pdf
[394] Benjamin, Brian, "How to Plan for Disruptions in the Food Supply Chain," Supply Chain Brain, September 15, 2014, accessed July 28, 2015.
[395] International Energy Agency, "World Energy Outlook 2013. Factsheet 2013. Page 1.

The recent US government approval for Shell Oil to drill in Alaskan coastal waters indicates that exploration and development of oil and gas supplies through traditional extraction methods will most likely continue. Similar investments projected to last at least a half-century or more will also strengthen concerns over their safety and security. The British Petroleum accident in Caribbean waters just off the coast of Louisiana, the anniversary of the Exxon Valdez oil spill in similar Alaskan waters, and the continued political fight over building pipelines from Canada's shale oil fields to US ports are just a few unsettling reminders of the risks ahead.

New, unconventional technologies, while unleashing a boom in energy production, also carry a disruptive potential for oil and gas supply chains. The fracking boom has already generated pressure to build new supply chains and adapt older ones throughout the US and across the border with Canada. For now, the rush to get oil and gas to consumers has had to rely on traditional transportation systems, older technologies, and rail routes through communities that are unprepared to handle new hazards. Dramatic, tragic derailments have caused explosions that leveled the downtown areas of local communities, polluted rivers, and overwhelmed emergency responders. They have also generated political and social tensions between the public and private stakeholders that are essential to the successful functioning of these essential supply chains.

Although in the US the private sector holds most of the responsibility for supply chain security and resilience, public authorities in the US and Canada have joined forces to update strategies to align with new economic realities. Drawing on the National Strategy's public-private partnership arrangements, the US Department of Transportation, the American Association of Railroads, and Canadian authorities have developed new safety and security regulations, begun to redesign and reroute the rail system, sponsored joint research and development to modernize rail cars, and started to update emergency responder capabilities and supplies throughout communities through which hazardous oil supplies transit.

Natural gas, in contrast, which heats over fifty percent of US homes, already has a supply chain that in many ways meets security and resilience standards. For example, the natural gas supply chain contains rapid response capabilities, including automatic response triggers, that are able to interrupt gas flows to prevent cascading failures. It also has redundancies that provide a way to bypass chokepoints throughout the supply chain. Risks are also diminished by the sheer size and diversity of the industry. The US has nearly 500 natural gas processing plants, 400 or so large-scale storage facilities, and an integrated distribution grid that covers over 300,000 miles of natural gas pipelines. Natural gas is also not in short supply. In just the last few years, exploration in

the US has discovered cleanburning natural gas reserves that could serve projected US needs for at least 100 years.[396]

The US electricity grid faces a more checkered outlook. The National Academy of Engineering recently celebrated electrification – the generation, transmission, and distribution of electricity - as the Nation's most important engineering achievement of the 20th century.[397] The 21st Century will pose significant challenges to keeping up with this dramatic accomplishment. Aging infrastructure and recurring system wide failures make it difficult and very expensive for the Nation to meet new environmental standards and to protect the supply chain from potential natural and manmade disasters. In 2012, for instance, investor-owned electric utilities and stand-alone transmission companies invested $35 billion in basic infrastructure.[398] At the same time, the electric power industry is investing more than $90 billion each year, on average, to modernize the grid to support a 21st-century digital economy.[399]

The vulnerability of the US electricity grid underscores how small, often weather-related disruptions can quickly cascade across broad regions to become system-wide failures.[400] Severe wind and thunderstorms, for instance, have devastated power systems in the Midwest and Mid-Atlantic, causing blackouts for five million electric customers from Illinois to New Jersey. In October 2012, Hurricane Sandy cut power to more than 10 million homes and businesses in 17 States.[401]

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[396] American Petroleum Institute. Energy. Securing our Natural Gas Supply Chain. American Petroleum Institute, Washington, DC. 2013. http://www.api.org/~/media/Files/Policy/Safety/API-Natural-Gas-Supply-Chain.pdf

[397] "The Greatest Engineering Achievements," National Academy of Engineering, http://www.greatachievements.org/.

[398] "EEI Survey Shows Electric Power Industry Made Record Levels of Investment in Transmission and Distribution," Edison Electric Institute, December 18, 2013, http://www.eei.org/resourcesandmedia/newsroom/Pages/Press%20Releases/EEI%20Survey%20Shows%20Electric%20Power%20Industry%20Made%20Record%20Levels%20of%20Investment%20in%20Transmission%20and%20Distribution.aspx.

[399] "EEI Statement on EPA's Proposed Guidelines for Greenhouse Gas Emissions from Existing Generation Sources," Edison Electric Institute, June 2, 2014, http://www.eei.org/resourcesandmedia/newsroom/Pages/Press%20Releases/EEI%20Statement%20on%20EPA%E2%80%99s%20Proposed%20Guidelines%20for%20Greenhouse%20Gas%20Emissions%20from%20Existing%20Generation%20Sources.aspx.

[400] "The components of the energy supply chain." Energy API. Securing Our Natural Gas Supply. http://www.anga.us/media/content/F7BE35D7-E47C-5BB9-DA1CBB373BFBDB3C/files/ihs%20global%20insight%
http://www.eia.gov/todayinenergy/detail.cfm?id=12191
http://www.ihs.com/info/ecc/a/shale-gas-jobs-report.aspx

[401] "Practicing Risk-Aware Electricity Regulation: 2014 Update," Ceres, November 2014, http://www.ceres.org/resources/reports/practicing-risk-aware-electricity-regulation-2014-update.

The US electricity grid is also vulnerable to sabotage. In April 2013, for example, attackers used high-powered rifles to destroy power transformers at a transmission substation in California. Although the targeted utility avoided a blackout, the incident caused more than $15 million in damages and required nearly a month to recover.[402]

8.3.2 Governance of Energy Supply Chain Management

In the US, responsibility for the security and resilience of these and other energy supply chains (e.g., nuclear)[403] rests first and foremost with private sector owners and operators. Consistent with overall US national strategy, however, the government supports the private sector through the energy sector's public-private partnerships.[404] Operating under the CIPAC framework of the National Infrastructure Protection Plan, the Electricity and Oil and Natural Gas Subsector Coordinating Councils (SCCs) and the Energy Government Coordinating Council (GCC) bring together the utility CEOs and trade association leaders representing all segments of industry. Through public-private collaboration, these councils have produced reliability standards for much of the energy infrastructure,[405] generated equipment sharing

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[402] Ibid.

[403] There are 99 nuclear reactors operating in the United States, and the industry has submitted license applications to the Nuclear Regulatory Commission for new reactors. Several billion dollars have already been spent on new plant activities, including the ordering of long-lead components. From the earliest stages of development, the successful construction of new plants depends on a robust supply chain to support nuclear manufacturing. Nuclear plants are comprised of hundreds of components and subcomponents, whose construction will require a deep and diverse supplier base. Nuclear manufacturers supply the concrete, pumps, wires, instruments and many other components necessary to support current and future nuclear power projects.
Supply Chain Facts and Figures. White Paper: Nuclear Energy's Economic Benefits; Manufacturing Capacity Assessment (NEI Members); Supply Chain Map: New Reactor Components, http://www.nei.org/Issues-Policy/Exports-Trade/US-Manufacturing-Supply-Chain.

404 U.S. Department of Homeland Security, DHS Risk Lexicon: 2010 Edition (DHS, September 2010), https://www.dhs.gov/xlibrary/assets/dhs-risk-lexicon-2010.pdf; U.S. Department of Homeland Security, "Designation of the National Infrastructure Protection Plan Critical Manufacturing Sector," Federal Register (April 30, 2008), https://www.federalregister.gov/articles/2008/04/30/E8-9412/designation-of-the-national-infrastructure-protection-plan- critical-manufacturing-sector; National Association of Manufacturing, "Facts About Manufacturing," http://www.nam.org/Newsroom/Facts- About-Manufacturing/

[405] "FERC Proposes to Approve Physical Security Reliability Standard," FERC, July 17, 2014, https://www.ferc.gov/media/news-releases/2014/2014-3/07-17-14-E-8.asp#.VBmhM5RdUa4; "Project 2013-03 Geomagnetic Disturbance Mitigation." http://www.nerc.com/pa/Stand/Pages/Project-2013-03-Geomagnetic-Disturbance-Mitigation.aspx.

programs[406] and completed joint threat analyses and risk assessments.[407] Industry trade associations play an important role in this coordination and collaboration. For instance, the Electricity Subsector Coordinating Council includes the Edison Electric Institute, the National Rural Electric Cooperative Association, and the American Public Power Association.[408]

The public-private partnership model also supports regional initiatives designed to address cross sector interdependencies and incident response. In particular, the Energy Government Sector Coordinating Council includes the National Association of State Energy Officials (NASEO) and the National Association of Regulatory Utility Commissioners (NARUC). Their cooperation has produced Energy Assurance Guidelines that identify State governments' overall role in energy assurance.[409] The Federal Department of Homeland Security also leads a Regional Resiliency Assessment Program (RRAP), which includes both regional analyses and exercises with local exercises and coordinating activities. [410] Regional programs underpin the cooperation found within and between mutual assistance groups that organize how investor-owned utilities respond to and help neighboring utility companies during an emergency.

8.3.3 International Cooperation

The US depends on and works with its international partners to foster cross-border flows of energy resources and to share global information and investment capital to secure its supply chains.[411] North America, in particular, is an integrated system of oil and natural gas pipelines and electricity

[406]http://www.eei.org/issuesandpolicy/transmission/Pages/sparetransformers.aspx and http://www.nerc.com/pa/RAPA/sed/Pages/Spare-Equipment-Database-(SED).aspx

[407] US Department of Energy, "Large Power Transformers and the U.S. Electric Grid," April 2014.http://www.energy.gov/sites/prod/files/2014/04/f15/LPTStudyUpdate-040914.pdf

[408] Electricity Subsector Coordinating Council (ESCC) Brochure, February 2014, http://www.publicpower.org/files/PDFs/ESCC%20Overview%20Brochure%20-%20February%202014.pdf.

[409] www.naseo.org/eaguidelines)

[410] US Department of Homeland Security, "Regional Resiliency Assessment Program (RRAP)," http://www.dhs.gov/regional-resiliency-assessment-program.

[411] Maull, Hanns, "Global Shift: The Challenges of Energy Interdependence and Climate Change," Transatlantic Academy Paper Series, September 2011, http://www.gmfus.org/wp-content/blogs.dir/1/files_mf/maull_climateenergy_aug11_final_web1.pdf.

transmission lines that crisscross the international boundaries of Mexico, the US and Canada.[412]

The US critical infrastructure, public-private partnership model aligns with these North American realities and includes representatives from both Canada and Mexico. Canadian government agencies, Natural Resource Canada and Public Safety Canada, are routine participants in these partnerships. The Pacific Northwest Economic Region (PNWER) expands the model of international cooperation to include public and private partners, and State and Provincial governments, from both sides of the US-Canada border. The US and Canada also have a formal Critical Infrastructure Protection Framework for Cooperation that promotes an integrated approach to security and resilience.[413] Similarly, the Trilateral Electric Reliability Oversight Group, established in 2004, includes participation from the Canadian Federal-Provincial-Territorial Electricity Working Group, the US Department of Energy, and the Government of Mexico.

8.3.4 Future Challenges and Strategies

The Energy Sector will continue to face physical security risks, including attacks to its physical and cyber infrastructure, that could create devastating catastrophic failures.[414] According to both private and public sector leaders, the top security and resilience challenges relate to visibility into and the reliability of supply chains. Disruptions will continue as supply chains become more complex, the number of suppliers and their internal systems expand, and the quality and predictability of the movement of materials throughout the networks remain uncertain. Future growth and security will be especially less than optimal if public-private partnerships, combining the resources and authorities of private companies and government, fail to achieve real-time monitoring of integrated transportation systems. For many private sector partners, it is government authorities that have the primary responsibility for regulating and monitoring many of these supply chain participants domestically and internationally.

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[412] US Department of Homeland Security, 2009 National Infrastructure Protection Plan, section 4.1.2.3, p. 52 http://www.dhs.gov/xlibrary/assets/NIPP_Plan.pdf (March 2009).
[413] US Department of Homeland Security and Public Safety Canada, "Canada-United States CIP Framework for Cooperation," September 2008. https://www.dhs.gov/xlibrary/assets/ip_canada_us_action_plan.pdf
[414] FERC, Reliability Standards for Physical Security Measures, 146 FERC ¶ 61,166, March 7, 2014, http://www.ferc.gov/CalendarFiles/20140307185442-RD14-6-000.pdf

8.4 Pharmaceutical Supply Chains

8.4.1 Overview – current situation and upcoming trends

Globalization continues to strengthen the Pharmaceutical sector's economic performance through expanding and diversifying suppliers and consumers, especially into emerging markets and through the expansive use of generic drugs. These steps have also increased the sector's supply chain risks. Supply chain disruptions have grown as private businesses struggle with global differences in standards, regulations, compliance rules and social and environmental conditions. Several large US pharmaceutical companies, for instance, have suffered damages to their reputations and share prices after becoming embroiled in supply chain scandals involving suppliers based outside the US.[415]

Overall, pharmaceutical supply chains are complex and generally involve organizations that perform overlapping roles in the distribution and contracting of the drug supply. According to the Kaiser Family Foundation, a leading healthcare monitor, much of this complexity is not well understood by policymakers, consumers or patients.[416] The global pharmaceutical manufacturing industry is huge and involves myriad organizations and government agencies that have overlapping roles in the contracting and distribution of the drug supply. The US represents the largest single market for pharmaceuticals and is deeply embedded in the supply chains that reach throughout the world.

Like global industry in general, pharmaceutical supply chains have benefitted from the efficiencies of a "just-in-time" delivery model. The push to raise productivity and cost-efficiencies, however, has also limited inventories and made access to critical drug supplies more vulnerable to the cascading consequences of system-level disruptions that originate far beyond the control of individual companies or the US government. With approximately 92 percent of the assets in this sector owned by private companies,[417] the health and security of the US population residents depends on the success of pharmaceutical manufacturers and the far-flung networks of wholesalers and distributors.

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[415] Brooks, Robert, "Pharma must map its supply chains to manage risks and rewards of emerging markets," January 22, 2014. Pharmaphorum.com
[416] Kaiser Family Foundation, Follow The Pill: Understanding the U.S. Commercial Pharmaceutical Supply Chain. March 2005. Kaiser Report follow-the-pill-understanding-the-u.s.-commercial-pharmaceutical-supply-chain-report.pdf.
[417] Government Accountability Office (2006). Critical Infrastructure Protection: Progress Coordinating Government and Private Sector Efforts Varies by Sectors' Characteristics p.28. http://www.gao.gov/assets/260/252603.pdf

8.4.2 Governance and Organization of Pharmaceutical Supply Chains

The organizational structure of the pharmaceutical supply chain involves numerous participants and linkages among companies, government institutions, distributors and consumers.[418] Pharmaceutical manufacturers consist of a few, relatively large, multinational firms that dominate prices, expected demand and drug availability. They manage the actual distribution of drugs from manufacturing facilities to drug wholesalers, and in some cases, directly to retail and mail order pharmacy chains, and to some hospitals and health plans, including government purchasers. In the US, very few drugs are distributed directly to consumers.

According to the Kaiser Foundation overview of the industry, wholesale distributors of pharmaceuticals are also few in number and have declined precipitiously over the last 30 to 40 years. In the 1970s, the number of wholesale distributors reached around 200 firms. Today, the top 3 wholesale distributors now account for 90 percent of the market. In contrast, pharmacies, and especially mail-order sales, are a rapidly growing segment of the US drug retail market. Many work directly with the manufacturers and wholesalers to acquire discounts and rebates based on volume sales or market share. Pharmacy benefit managers are also a large part of this highly concentrated industrial sector and supply chain network.

8.4.3 Risks, Challenges, and Reforms

The structure and organization of pharmaceutical supply chains contain several systemic risks to its security and resilience.[419] The secular trend toward globalization multiplies the uncertainties associated with new partners operating outside of a private company's control. It also limits the reach of the US governments strategies to enhance the supply chain's security and resilience. Concentration within the industry from a decade of large mergers and acquisitions also restrict the availability of alternative drug supplies. Without a guaranteed market to realize a return on investments in specialized drugs, governments and communities may face drug shortages during unanticipated public health emergencies. The integrity of the drug supply is also increasingly under attack. Although the U.S. drug supply chain remains one of the safest in the world, they still face the threats of counterfeiting, diversion, cargo theft and importation of imitation or substandard drugs.

The US National Supply Chain Strategy specifically identifies the need to strengthen the drug supply chain as one of the nation's top priorities. In 2011,

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[418] Kaiser Family Foundation, Ibid, page 4.
[419] http://www.imshealth.com/ims/portal/front/articleC/0,2777,6599_49695974_68913551,00.html
http://www.supplychain247.com/images/article/Bristlecone_green_supply_chain_wp_image.jpg

the President issued an Executive Order designed to increase patient access to drugs and to encourage private companies to work with the FDA to prevent drug shortages. For example, if a drug shortage is anticipated, government guidelines encourage manufacturers to notify the Food and Drug Administration (FDA) in order to mitigate possible vulnerabilities. Government regulations also require private companies to inform the FDA six months in advance of a decision to discontinue a medically necessary drug that is produced through a single source.

The US Government also joined forces with the private sector to reinforce the security of the drug supply chain and to combat any deterioration in its overall integrity.[420] The 2012 Safety and Innovation Act, for instance, includes drug supply chain safety provisions that require the FDA, which has primary responsibility for pharmaceutical supply chains under the NIPP, to develop the capacity to identify and monitor the movement of goods and services for each registered participant in the supply chain. The US government also enacted The Drug Supply Chain Security Act (DSCSA), which is designed to create within ten years a system to help protect consumers from exposure to drugs that may be counterfeit, stolen, contaminated, or otherwise harmful. The core capability to be developed in this framework is to create and exchange information on each package of drugs in the supply chain from the point of production to their distribution throughout the system. New surveillance techniques aim to facilitate verification of the legitimacy of the drug product identifier, detect illicit products already moving throughout the drug supply chain, and notify potential consumers.

Unquestionably, these and other initiatives were launched in the last decades after a series of disruptions in the pharmaceutical supply chain. Public health emergencies arising from the H1N1 virus and the Ebola crisis, for instance, alerted the US government and the private healthcare industry to the current shortcomings of pharmaceutical supply chains. The deficiencies in US efforts to treat ebola patients exposed shortages of drugs and protective equipment, and the weaknesses of response protocols attached to the supply chain.[421]

These incidents also highlighted structural deficiencies in pharmaceutical distribution systems, especially at local levels. Until these emergencies, pharmacies represented nearly the only mechanism in the US for reaching local residents. Local government health departments had nearly the sole responsibility to ensure that required drugs were distributed to pharmacies for subsequent release. During the H1N1 pandemic scare, however, the pharmacy

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[420] See more at: http://www.phrma.org/media/releases/phrma-statement-president-obama%E2%80%99s-drug-shortages-executive-order#sthash.BIYTmvwt.dpuf

[421] Bush, Haydn, "Reliance on Overseas Manufacturers Worries Supply Chain Experts," Hospital and Health Networks Journal, 2011.

and local health department network was overwhelmed. New public-private initiatives, however, emerged spontaneously to provide alternatives that could more rapidly and widely dispense the drugs to individual patients.[422] In some locations, employers, community clinics, and even big box retail stores became dispensers of the medications. Private businesses then began to cooperate with the Centers for Disease Control and Prevention (CDC) to develop national agreements to allow large retailers – including Costco, Walmart, Target, and Home Depot, to use their own, very efficient and rapid logistical supply chains to spread medicines nationally.

The public-private sector partnership model also helped to develop and deliver medical countermeasures quickly and cost effectively. The Department of Health and Human Services, for instance, has financed a 'Medical Countermeasure Supply During a Public Health Emergency' program that combines the efforts of small biotech companies, academic institutions and large pharmaceutical firms to expanded the nation's domestic ability to respond to bioterrorism threats, pandemic influenza, and other epidemics.

8.5 The Water-Energy-Food Nexus

Although US supply chain strategies are generally structured around specific critical infrastructure sectors, they are not meant to promote separate actions, goals and priorities. US strategies are increasingly focused on the risks associated with interdependencies among multiple supply chains – a nexus of interlocking activities that better represent the comprehensive risks facing the nation. The focus of this evolving strategic priority is evident in the following four areas.

A. Cross-sectoral partnerships.

The growing nexus among the various lifeline functions - water, food, energy and transportation[423] - is increasingly supported by cross-sector coordinating councils that work with the separate sector councils to share risk information, exchange best practices, build situational awareness, communicate during times of duress and enable risk-based decisions. The

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[422] Elsenboss, Carina, "A Whole Community Approach to Medication Dispensing," Preparedness Brief, National Association of County and City Health Officials, Summer 2014. http://nacchopreparedness.org

[423] US Department of Homeland Security, "Designation of the National Infrastructure Protection Plan Critical Manufacturing Sector," Federal Register, April 30, 2008, https://www.federalregister.gov/articles/2008/04/30/E8-9412/designation-of-the-national-infrastructure-protection-plan-critical-manufacturing-sector; US Department of Homeland Security, The National Infrastructure Protection Plan 2013: Partnering for Critical Infrastructure Security and Resilience (NIPP 2013); Presidential Policy Directive 21: Critical Infrastructure Security and Resilience.

National Infrastructure Advisory Council (NIAC) examined these and other interdependencies in the wake of a pandemic threat. The Council observed that:[424]

> "the complexity of interdependencies among [CI]…sectors cannot be understated. Furthermore, as business operations change and criticalities evolve, interdependencies shift in importance… these interdependencies must be mapped clearly so sectors are better able to protect their critical assets … and better prepared to defend themselves against potential cascading failures across sectors."

B. Cross-sectoral information sharing.

A particular challenge to public and private coordination of supply chain interdependencies involves sharing and protecting proprietary information. Recently, the White House issued Executive Order 13691, Improving Private Sector Information Sharing, to encourage and promote the sharing of threat information within the private sector and between the private sector and government, including sensitive security information, sensitive business and proprietary information, and, in some cases, classified information. In highly competitive industries dominated by a few large companies, however, sharing of this type of information risks violation of anti-trust laws designed to maintain open markets, fair prices, and adequate supplies.

To manage this potential conflict, the President's order limits liabilities for private companies and creates an intermediate mechanism through which the information can be reported. An intermediate organization holds and protects the confidential information and uses it only in aggregated form as part of security alerts and risk assessments.425

C. Climate Change Strategies

Although the causes of climate change still remain a target of political argument in some parts of the US, the ways in which changing weather patterns disrupt entire clusters of overlapping supply chains have been widely acknowledged. In the energy sector, for instance, surveys of the 100 largest U.S. exploration and production companies identify changes in climate[426] as the single disruption that could force the present energy

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[424] http://www.dhs.gov/xlibrary/assets/niac/niac_CBR_FINAL_REPORT.pdf

425 Letter RE: Generic Pharmaceutical Association Advisory Opinion from Markus Meier, Assistant Director, Federal Trade Commission, Bureau of Competition, Health Care Division, Washington, DC, to E. John Steren. August 8, 2012. Also, see http://www.phrma.org/media/releases/phrma-statement-president-obama%E2%80%99s-drug-shortages-executive-order#sthash.BIYTmvwt.dpuf

[426] See 2013 BDO Risk Factor Report for Oil and Gas Businesses, June 2013, http://www.lumsdencpa.com/documents/OilGasRiskFactorReport2013June.pdf.

system outside of its current sustainable patterns.[427] Private-public partnership councils also consistently identify weather-related events as among the biggest threat to the reliability of the electric grid. Energy supply chains will also be affected as changing climate patterns increase the frequency and intensity of extreme weather events. Sea level rises[428] and decreasing water availability, for instance, will affect hydropower and other weather-driven renewables and the reliability of pipelines and electricity grids.[429]

In November 2013, the President signed Executive Order 13653, "Preparing the United States for the Impacts of Climate Change," that established an interagency Council on Climate Preparedness and Resilience and directed Federal agencies to promote strong partnerships to expand information sharing and risk-informed decision-making related to climatic risks.[430] Federal agencies, such as the National Oceanic and Atmospheric Administration, launched campaigns to "promote public understanding of climate science and climate-related events . . . and to provide climate-related support to the private sector and the Nation's economy."[431]

Awareness of the potential for cascading damages across interlocking supply chains due to climate change is becoming widespread.[432] The Department of Energy, for instance, recently reported on how extreme weather and climate change threaten the core infrastructure that provides basic services, including phones, water, health care, and electricity.[433] The Government Accountability Office (GAO), the Federal government's

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[427] Ibid.
[428] US Department of Energy, "U.S. Energy Sector Vulnerabilities to Climate Change and Extreme Weather," July 2013, http://energy.gov/sites/prod/files/2013/07/f2/20130710-Energy-Sector-Vulnerabilities-Report.pdf.
[429] World Energy Council, "Climate Change: Implications for the Energy Sector," June 13, 2014, http://www.worldenergy.org/news-and-media/news/climate-change-implications-for-the-energy-sector-key-findings-from-the-ipcc-ar5/.
[430] The White House, "Executive Order -- Preparing the United States for the Impacts of Climate Change," November 1, 2013, http://www.whitehouse.gov/the-press-office/2013/11/01/executive-order-preparing-united-states-impacts-climate-change.
[431] National Oceanic and Atmospheric Administration, www.noaa.gov and http://climate.gov/.
[432] US Department of Energy, "U.S. Energy Sector Vulnerabilities to Climate Change and Extreme Weather," July 2013, http://energy.gov/sites/prod/files/2013/07/f2/20130710-Energy-Sector-Vulnerabilities-Report.pdf.
[433] US Department of Energy, Climate Change Serious Threat to America's Basic Infrastructure, March 7, 2014.

watchdog agency, also concluded that nearly all elements of the US energy infrastructure are increasingly vulnerable to climate change impacts.[434]

The current historic drought in the Western states demonstrates in real-time the effects of extreme climate shifts on intersecting supply chain clusters. In Phoenix, Arizona, for instance, depletion of groundwater under the soil is causing the land to shrink, for some areas by nearly as much as an inch per year. This "subsidence" threatens to undermine the stability of existing infrastructure, including canals, utility lines, sewers and even building foundations.[435] As the soil changes, the cascading impacts affect both food and water supplies, energy production and transportation security. A recent GAO study, Climate Change: Energy Infrastructure Risks, and Adaptation Efforts, concludes that these changes "are projected to affect infrastructure throughout all major stages of the energy supply chain, thereby increasing the risk of disruptions. The Department of Health and Human Services adds that these climate shifts will put a

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[434] NERC, "ERO Reliability Risk Priorities RISC Recommendations to NERC Board of Trustees," October, 2014. http://www.nerc.com/comm/RISC/Related%20Files%20DL/ERO%20Reliability%20Risk%20Priorities%20%20RISC%20Updates%20and%20Recommendations%20-%20October%202014%20r1.pdf; State of Reliability 2014, NERC, May 2014, http://www.nerc.com/pa/RAPA/PA/Performance%20Analysis%20DL/2014_SOR_Final.pdf; http://energy.gov/sites/prod/files/2014/04/f15/LPTStudyUpdate-040914.pdf Order RD14-6-000, Reliability Standards for Physical Security Measures, 146 FERC ¶ 61,166, March 7, 2014, http://www.ferc.gov/CalendarFiles/20140307185442-RD14-6-000.pdf. "FERC Proposes to Approve Physical Security Reliability Standard," FERC, July 17, 2014, https://www.ferc.gov/media/news-releases/2014/2014-3/07-17-14-E-8.asp#.VBmhM5RdUa4; "Project 2013-03 Geomagnetic Disturbance Mitigation," NERC, http://www.nerc.com/pa/Stand/Pages/Project-2013-03-Geomagnetic-Disturbance-Mitigation.aspx.
http://www.eei.org/issuesandpolicy/transmission/Pages/sparetransformers.aspx and http://www.nerc.com/pa/RAPA/sed/Pages/Spare-Equipment-Database-(SED).aspx.
"Large Power Transformers and the U.S. Electric Grid," DOE, April 2014, http://www.energy.gov/sites/prod/files/2014/04/f15/LPTStudyUpdate-040914.pdf.
http://www.dhs.gov/files/programs/st-snapshots-prototyping-replacement-ehv-transformers.shtm.
US Department of Energy, "U.S. Energy Sector Vulnerabilities to Climate Change and Extreme Weather," July 2013, http://energy.gov/sites/prod/files/2013/07/f2/20130710-Energy-Sector-Vulnerabilities-Report.pdf.
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[435] Quinn, Rob, "Phoenix Is Slowly Sinking. Subsidence Can't be Stopped, Researchers Say," Newser, August 13, 2015. http://www.newser.com/story/211253/phoenix-is-slowly-sinking.html?utm_source=part&utm_medium=foxnews&utm_campaign=rss_science_syn

progressively greater strain on communities and lead to more public health emergencies.[436]

D. Cyber Security and Cooperation

Cybersecurity is especially important to the future security and resilience of complex supply chain interactions. Cyber security risks are now deeply embedded in critical infrastructure management as supply chains become ever more dependent electronically on sharing information and coordinating assets and actions. Presidential Executive Order 13636 provides guidance to improve and strengthen the cross-sectoral partnership structure to customize strategic guidance against these evolving risks. The President's 2013 initiative directed the National Institute of Standards and Technology (NIST) to work with industry partners and other government agencies to develop a cybersecurity framework.[437] As both private and public sector strategies increasingly brace for significant increases in the complexity of supply chains, cyber partnerships will likely become the cutting edge of the US national strategy to strengthen domestic and global supply chain security and resilience. [438]

[436] Primary Protection: Enhancing Health Care Resilience for a Changing Climate. http://toolkit.climate.gov/topics/human-health/building-climate-resilience-health-sector

[437] Electricity Subsector Cybersecurity Capability Maturity Model, http://energy.gov/sites/prod/files/2014/02/f7/ES-C2M2-v1-1-Feb2014.pdf; Oil and Natural Gas Subsector Cybersecurity Capability Maturity Model http://energy.gov/sites/prod/files/2014/03/f13/ONG-C2M2-v1-1_cor.pdf.

[438] The White House, "The International Strategy for Cyberspace," May 11, 2011. http://www.whitehouse.gov/sites/default/files/rss_viewer/international_strategy_for_cyberspace.pdf.