### Agriculture ADV---1AC

#### Advantage one is AG.

#### Farm supply chains are bottlenecked by an oligopsony of intermediaries. This creates systemic fragility driving ecological collapse.

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20 General conclusions

Agri-food markets are governed differently from other sectors. Competition policy providing direction for agri-food markets is not limited to antitrust law but also leaves room for other regulatory means. In other words, agri-food markets are influenced and controlled by both antitrust and regulation. This is manifest both in the European Union and the United States. The dual nature of regulating competition in agri-food markets is primarily based on the policy choice and value decision that agricultural producers deserve additional protection in order for a fair standard of living to be ensured for them and their individual earnings to be increased. From the viewpoint of the primary means of competition policy, that is from the viewpoint of antitrust, this policy choice is deemed inefficient in several cases. Trade regulation rules, such as the prohibition of unfair trading practices, cannot be justified with the grounds and reasons underpinning antitrust. They have their own function which sometimes contradict conventional antitrust considerations, sometimes coincide with them. From an antitrust standpoint, the previous is more frequent, even more so when the objective of consumer welfare is considered the one and only legitimate goal of antitrust. Contradiction may arise, for example, when the buyer of an agricultural product uses its superior bargaining position, depresses the price of the product to the extent that the producer receives no appropriate (even below-cost) payment, but this depressed farm gate price results in a lower price for consumers because of intensive horizontal competition between the respective buyer and its competitors (passing on of the lower price to consumers takes place).

The main purpose of antitrust, to increase efficiency, runs counter to those objectives of agricultural policy that are redistributive in nature, such as ensuring a higher living standard for agricultural producers. The clash of objectives, however, has been settled by declaring that agricultural policy takes precedence over competition rules. It is explicitly proclaimed in EU primary law. Although no similar declaration is found in the United States, the same commitment emerges implicitly by adopting trade regulation rules that do not require the proving of negative effects on competition. These provisions are in many cases contradictory to efficiency-based considerations emphasised by mainstream antitrust, however, they do not prevent antitrust enforcement from coming to the fore.

Their relationship can be drawn as the violation of trade regulation rules not necessarily being covered by antitrust, but the violation of antitrust rules are presumably covered also by trade regulation. For example, an unfair trading practice against a supplier does not trigger antitrust enforcement, but a unilateral and anticompetitive trading practice with adverse effects on competition by a dominant undertaking also falls under the category of unfair trading and could trigger enforcement based on provisions aimed at preventing unfair trading practices. That is, trade regulation extends its protective scope to practices that are not prohibited by antitrust.

Given that the EU is an open proponent of the multifunctional model of agriculture, the policy choice is undeniable. Multifunctional agriculture embodies an approach that goes beyond the view of looking at agriculture as only a sector producing commodities. It craves the protection of rural lifestyle and landscapes and of agricultural producers living in rural areas. Agriculture also serves social, cultural and traditional functions. This approach is reflected in competition-related rules when agricultural producers are provided with antitrust law exemptions and additional market protection based on quite weak economic but satisfactorily strong social arguments.

In general, agri-food markets have become more concentrated horizontally and more integrated vertically; there are less family farms and smallholders, but we see that food prices are still increasing. Small and medium-sized family farms and agricultural producers sell their produce at lower prices than it would be worth for them, but lower prices paid to producers do not appear as lower prices paid by consumers. Somewhere in the food supply chain, at the level of intermediaries (food processors, wholesale dealers, retailers) these amounts get stuck. Intermediaries between producers and consumers pay less but charge more. It should not be even acceptable from a narrow antitrust standpoint. Consumer welfare does not seem increased by rising vertical integration and horizontal concentration of the food supply chain. No surplus is realised by consumers. They pay more for foodstuffs, but producers have to charge less to stay in the business.

The system’s beneficiaries are intermediaries: food processors, wholesalers, retailers. The system is shaped like an hourglass. There is one end point with millions of producers, and there is the other end point with billions of consumers. The two end points are connected to each other through a significantly lower amount of intermediaries who are in a winning situation both upstream and downstream. Most foodstuffs are price inelastic. We all eat. Changes in the prices of basic food staples do not change the demand significantly, therefore intermediaries, in particular retail chains, do not have to expect significant decrease in the demand, if they increase the price of basic foodstuffs. Nevertheless, the most diverse types of dependence suffered by producers as suppliers on buyers forces producers to accept terms and conditions dictated by buyers in order for them to remain in the business.

In the EU, intermediaries in the food supply chain are also given preferential treatment as regards their sustainability agreements. As demonstrated earlier, exempting certain agriculture-related sustainability agreements from the prohibition of anticompetitive agreements requires only one party who is an agricultural producer, and, besides this one and only producer, it may happen that other operators downstream (processors and/or traders) join forces to enjoy the advantages of the derogation. Thanks to this lax provision, it is obvious that the intermediaries, who have in many cases superior bargaining position over their suppliers (the producers), can make use of the alleviation, but will not solve the environmental problems caused by the agricultural sector.

21 Conceptualising food sovereignty with ordoliberalism969

In view of these considerations, and taking into account that I have already outlined the food sovereignty’s approach towards competition, subsequently, I examine whether ordoliberalism can be brought into line with the emerging paradigm of food sovereignty. The starting point for this is the viewpoint taken by the European Union, given that ordoliberalism – both in terms of legislation and enforcement – has had a significant impact on the competition policy of the EU.

Moreover, this chapter aims to add a further layer to the possible interpretation of ‘sovereignty’ in ‘food sovereignty’. While doing so, in parallel I bring to the fore the tenets of ordoliberalism and ordoliberal competition policy, which may serve as potential interfaces between them and food sovereignty.

In Chapter 17, I argued for a state-centred concept of sovereignty, which would be advantageous to food sovereignty movements. This approach is only the substantial aspect of the question. It is based upon the acknowledgement that the modern state with its legislative powers has exclusive authority to adopt legally binding rules that influence each and every aspect of life, including economic relations between market players. If appropriate legal rules are adopted (that is, the legal norms adopted are indeed capable of delivering the desired outcomes), this is the most efficient way to attain policy objectives represented by any interest group. If not, the modern state plays the role of legislator, but a supranational organisation, such as the EU, with the authority to adopt directly applicable and binding legal norms, is derived also from a state-centred sovereignty concept. The state that is a member of the European Union shall voluntarily accept, by signing the accession treaty, that a part of its legislative powers in clearly determined areas is transferred to the supranational level.

The layer I aim to add here to the concept of sovereignty within food sovereignty is of procedural nature. This is closer to the ‘multiple sovereignties’ approach, however, it does not call into question the exclusivity of the state either in the determination of legal provisions that may deliver the clearly formulated objectives, or in deciding whether a part of its sovereignty is transferred to other organisations. These two pathways are handled as one in the following.

If we accept Raf Geenens’ interpretation of sovereignty, one of the main goals of ordoliberalism, i.e., ensuring autonomy for citizens against private and public monopoly powers through a constitutional economic framework, can be raised to the level of collective autonomy within the framework of the agriculture and food supply chain. He uses the term ‘sovereignty’ as “the name for the perspective a community adopts when it sees itself as collectively autonomous.”970 Within the domain of agriculture and food supply chain, food sovereignty can be perceived as the perspective of a collectively autonomous community making a stand for defining their agricultural and food policy. To mention one example, most agricultural producers share the vision that trade in agri-food products and the food chain in general should be fairer, more balanced and more transparent. This demand is one of the most emphasised and important topics in agricultural policy-making processes. Agricultural producers appear as collectively autonomous in fighting for their common goal. By making a stand for certain demands, they aim to define their own agricultural and food policy.971 Though agricultural producers are to determine the desired outcomes, the attainment of these objectives are placed into the hands of the state through adopting appropriate legal provisions. To be effective, producers must channel their desires into the state machinery’s legislative processes.

With this conceptualisation, we have to give up neither the ordoliberal approach of competition, i.e., the claim for setting up the rules of the game through state regulation, nor the concept of food sovereignty. Furthermore, we can seize food sovereignty as a kind of collective autonomy, which can be led back to the notion of individual autonomy as a value to be protected by ordoliberalism. If we accept the ordoliberal viewpoint, and thus the necessity of regulating competition through general rules, and we also accept Röpke’s ordoliberal remark on agriculture, which holds that “in this sector . . . a particularly high degree of far-sighted, protective, directive, regulating and balancing intervention is not only defensible, but even mandatory,”972 the concept of food sovereignty can be easily reconciled with the ordoliberal approach protecting individual autonomy against public and private constraints of competition. It is one step from the individual to the collective level, from the individual autonomy protected by ordoliberalism to the concept of food sovereignty perceived as a collective autonomy of a community with the emphasised aim of challenging the restrictions of competition exercised by agribusiness, i.e., giant food enterprises, be they processors, wholesalers or retail chains.

Geenens pronouncedly builds his theory of sovereignty as autonomy upon the works of Habermas. He emphasises that Habermas provides “the most elaborate account of sovereignty as autonomy.”973 The remarks of Habermas in one of his books can be drawn as an exact parallel to the viewpoint of ordoliberalism. He is of the opinion that “basic rights must now do more than just protect private citizens from encroachment by the state apparatus, [p]rivate autonomy is endangered today at least as much by positions of economic and social power.”974 Ordoliberalism has the same approach: it cannot imagine a mode of economy other than the market economy but wants to set up the rules of the game within the framework of which market actors will perform their economic activities. It is coherent with the view of Habermas: “it has become impossible to break out of the universe of capitalism; the only remaining option is to civilise and tame the capitalist dynamic from within.”975 The instrument for civilising and taming the capitalist dynamic is none other than creating competition rules within an economic constitutional framework which highlights economic liberties and individual autonomy. Ironically, the aim of competition policy is to save capitalism from itself.976

Although it seems paradoxical to support individual autonomy and collective autonomy at the same time, these two types of autonomy are understood by myself as categories in two different spheres. Individual autonomy (individual economic freedom) as protected by ordoliberalism refers to the capacity to live one’s life according to reasons and motives that are taken as one’s own and not according to manipulative and/or distorting external forces. That is to say, it refers to being economically independent. In its ordoliberal sense, it is economic capacity and one of the most important principles of the economic constitutional framework. At the same time, food sovereignty perceived as a type of collective autonomy is a political term.977 Individuals can have individual autonomy, that is, they can be independent from an economic point of view, but when stepping up to the political arena, these individuals can determine themselves as collectively autonomous who all fight for their individual autonomy and for remaining independent. They become collectively autonomous through trying to achieve the same goal: maintaining their independence in, and by, determining their own agricultural and food policy. These notions, thus, have the same legal implications and can be connected to each other with a mutual legal objective: protecting agricultural producers, farmers, small and medium-scale enterprises by creating effective competition and trade rules and enforcing them in the same manner.

Ordoliberalism and food sovereignty have another common feature: they both intend to re-introduce and re-emphasise social issues in pursuance of their goals. In general, ordoliberalism aims to combine economic efficiency with a just and stable social order.978 The fact that ordoliberalism is also known as German neoliberalism should not mislead anyone: “[a]s a matter of legal and political form, ordoliberalism and neoliberalism are often in tension with each other, as ordoliberalism’s rule-based commitments come up against neoliberal discretionary politics.”979 The feature that distinguishes ordoliberalism from neoliberalism is that the latter views the world as a market and tries to govern it as if it were a market, and it refuses the separation of economic, social and political spheres, by “evaluating all three according to a single economic logic.”980 In contrast, the most significant notion of ordoliberalism carries its socially focused nature: social market economy.981,982 The concept of social market economy brought to the fore by Müller-Armack has at least three core concepts: (a) the preservation of the market economy as a dynamic order; (b) social equilibrium, which is subject to the observance of the first sentence; and (c) securing stability and growth through monetary and competition policy.983 The social market economy is a normative system based on values such as dignity, well-being, self-determination, encouragement, freedom and responsibility of all individuals; it is fully committed to a humane society in which “economic growth and social sustainability are compatible notions.”984

Contrary to ordoliberalism, neoliberalism lacks the desire to achieve social equilibrium and does not take into account concerns other than economic ones. That is the ground for me to reconcile food sovereignty with ordoliberalism. At the same time, this is the reason which establishes the impossibility for neoliberalism to be in line with food sovereignty. In each aspect, food sovereignty – as it has emerged as a social movement – pursues the aim of having social considerations taken into account during policy-making processes. The trait of ordoliberalism that it does not just consider economic efficiency as the exclusive objective of antitrust law means that other (noneconomic) considerations may be taken into account when adopting and enforcing competition rules in a broad sense.

Therefore, in an ordoliberal concept of competition law, which – as mentioned – does not limit itself to achieving one and only one objective, i.e., consumer welfare through economic efficiency, noneconomic aspects may also appear when deciding whether or not a conduct is harmful to competition. This means that food sovereignty with its social aims is not contrary to ordoliberalism. As the definition provides, food sovereignty does not negate trade but aims to create trade practices which are able to break the dominance of agribusiness. Doing so is motivated by social considerations which also appear in the ordoliberal line of thinking. The ordoliberal approach of adopting the rules of the game through legislation which directs the behaviour of market participants is in accordance with food sovereignty, since the latter also wants a level playing field.

“Food sovereignty promotes the role of the state as protector of farmers’ interests”985 which can only be realised through legislation. This does not mean that inefficient undertakings and market actors will be prioritised, but all operators in the respective market will have equal opportunities as a result of the aim of reaching social equilibrium. In the broadest context, the ultimate goal is that all market participants be part of a humane economy.986 Criticism may be made that this links competition policy with redistributive objectives, and redistribution is not an aspect with which antitrust law should deal. However, it is worth perceiving redistribution from another approach. Adopting the thoughts of Fox, if we refuse to accept that competition policy can, and should, contribute to redistribution987 and we view antitrust as something that should only deal with economic efficiency, we may also acknowledge that redistribution is taken over from the state by, and positioned in the hands of, giant undertakings.988 This is in line with food sovereignty’s contention that emphasises the problem of decreasing state regulatory power.989

The strength of food sovereignty is that it may provide us with answers at different levels,990 as well as that it has the feature of multi-interpretability.991 This allows us to identify two trends from different directions but leads to the same result. Ordoliberalism emphasises the role of the state in setting the rules of competition in the market (at the national and/or EU level), while food sovereignty seeks to restore the leading role of the state as protector of the agricultural community (at the international level). The result and the conclusion are the same in both cases: the state must take an active role in shaping competition and trade rules. This does not mean direct intervention into the relationship of market participants but signifies establishing those competition and trade rules according to which these market participants operate on the market.

By adopting the approach of ordoliberalism which goes beyond a single-purpose viewpoint towards antitrust law and by choosing the political category of food sovereignty as a possible conceptual framework in policy-making processes, one steps on the path of prosocial992 competition policy. By prosocial competition policy, I mean a mode of competition, including antitrust, legislation and enforcement that is sensitive to social issues and does not limit itself to achieving economic efficiency. By looking at the primary law of the European Union, Article 9 TFEU includes the horizontal social clause993 which requires that “social values have to be respected in all policy fields of the EU.”994 Of the few expressis verbis provisions on resolving the conflicts between competition and another policy, the subject of my study – agriculture – is one which establishes the specific social objectives to be considered when adopting and enforcing competition laws in the form of the provision formulated in Article 42 TFEU.995 As described earlier, Article 42 TFEU paves the way for the precedence of Common Agricultural Policy objectives over general competition rules.

The ordoliberal antitrust law objectives, such as the protection of the competitive process and of individual freedom,996 are in themselves appropriate to consider noneconomic factors when deciding whether a conduct is harmful to competition. This does not mean that the notion of prosocial competition policy would argue against the economic efficiency to be achieved by antitrust laws.

As a consequence of adopting a food sovereignty approach, we reject that food be purely commodified,997 and as a consequence of a socially responsive ordoliberal competition policy positioned in the framework of social market economy, we can take into account those dimensions of competition and trade in agricultural products and food which would remain invisible from a more economic approach limited to the objective of enhancing consumer welfare. As posited by Trauger, “[t] he commodification of food . . . has resulted in the vertical integration and the concentration of power in a few very large firms with national governments increasingly tailoring food regulation to the demands of agribusiness.”998

The food sovereignty movement’s demand to break the control and growing power of corporations over the food system999 is fully in accordance with the thoughts of ordoliberalism’s mainstream economist, Eucken. As explained in one of his major works, the state’s policy should be directed toward dissolving economic power groups or limiting their function.1000 It is not the only parallel which can be drawn between the key ordoliberal economist Eucken and food sovereignty: an overlap may also be found with regard to the requirement of contractual freedom. In Eucken’s view, freedom of contract should not be used in the competitive order to create dependencies between market players, that is, freedom of contract may not be granted for the purpose of concluding contracts that restrict or eliminate freedom of contract.1001 This tenet of Eucken may be a basis for regulating unfair trading practices in the food supply chain from an ordoliberal point of view, given that the UTPs, in most cases, constitute certain types of exploitative abuse which restrict the freedom of contract of that contracting party which is vis-à-vis the party having superior bargaining power. To be more exact, the weaker contracting party’s freedom to determine the terms of the contract is restricted due to economic dependence, and so this party is put in a position which – from a food sovereignty approach – is unacceptable because of the economic exploitation.1002 The ordoliberal concept of efficiency also includes “the continuing possibility of choice for the individual,”1003 of which the aforementioned behaviours deprive the agricultural producers, who are vulnerable in cases of bargaining with buyers being in a superior bargaining position.

The characteristic of food sovereignty that it can be interpreted at all levels means that the movement’s demand for ceasing unequal trading rules at the international level can be projected at the national and EU levels.1004 Ordoliberal competition policy and the social market economy constitute an appropriate framework to set up those competition and trade rules which take into account noneconomic (social) factors to provide protection for the weakest actors of the food supply chain, the farmers as well as small and medium-size enterprises. The food sovereignty movement promoting social justice1005 may find a useful partner in ordoliberal competition policy to establish the set of rules necessary to provide protection for the most vulnerable of the food supply chain. On the one hand, this ‘partnerin-crime’ role of ordoliberalism comes from the view of ordoliberal thinkers who dealt with agriculture, and on the other hand, from the general constituting principles drawn up by Eucken.

There are two conflicting viewpoints as to how the privileged position of the agricultural sector in relation to competition-related rules can be explained. The first point of view is that the favoured status of the sector is based on strong social and economic considerations and arguments. On the contrary, the second group takes the view that providing exemption from antitrust rules and stronger protection for agricultural producers are none other than the repercussions of strong, wellorganised and methodical agricultural lobbying both at the EU and national level. It may be more reasonable to unearth the middle ground: on the one hand, owing to the structural characteristics of agriculture and the factors beyond human control (for example, weather and climatic conditions), and, on the other hand, because of the products of primary agricultural production and food being essential to sustain human life, agricultural lobbyists are in a position to have a great impact on legislation, because their arguments – in many cases – seem quite valid (for example, regarding the weak bargaining position of producers, the struggle to ensure predictable income for themselves, changing weather and climatic conditions, etc.).

This gives justification for their ambition to fight for exemptions from antitrust and sector-specific rules for the agricultural sector not only at the EU but also national level. Although from the standpoint of conventional antitrust law which aims to achieve the highest possible economic efficiency, these arguments are often not satisfactory on the grounds of economics. The more we move away from the single-factor economic approach towards antitrust law and the more nonefficiency-based considerations we open the door for, the more acceptable the arguments of agricultural lobbyists are. The extent to which we commit ourselves to non-efficiency-based considerations in antitrust law determines whether there will be – and if yes, how many – exemptions and how much protection agricultural producers will enjoy. It can be imagined as a sliding scale whose one end point stands for economic efficiency exclusively and the other end point for nonefficiency-based considerations as an umbrella term. The extent of it is policy choice, therefore it is determined by relevant and current policy-makers. Viewed from another angle, other policies can, and will, undermine antitrust.1006

The relative autonomy of competition policy in agri-food markets from general antitrust law trends can be illustrated quite well by the fact that the prevalent antitrust doctrines in the last four decades in the United States (the paradigm of consumer welfare) and in the last 25 years in the EU (the more economic approach) have left untouched the competition-related exception and specific norms provided for agriculture. It is another reason as to why one should perceive competition rules of agri-food markets as an integral part of agri-food law rather than as part of competition law. The way competition in agri-food markets is governed is determined – to a significant extent – by agricultural policy objectives, and – to much less extent – by mainstream antitrust considerations. This is why antitrust lawyers often claim that the efficiency of agri-food markets has been sacrificed on the altar of considerations that have nothing to do with competition, such as ensuring a higher living standard for agricultural producers.

From the perspective of antitrust policy, trade regulation rules in agri-food markets– in many cases – point in the opposite direction than antitrust rules. However, from the perspective of agricultural policy, antitrust and trade regulation rules rather complement each other. While antitrust attacks those conducts that are contrary to economic efficiency, trade regulation attacks those which cannot be reached by antitrust enforcement.

These provisions serve to realise agricultural and food policy objectives, that is to say, they are an instrument in the hands of agricultural and food policy-makers. Their primary aim is to create a competitive environment that reduces the vulnerability of weak market actors in the food supply chain and, thus, raises the income of agricultural producers generated from the sales of their produce. This cannot be justified with the assessment methods of antitrust law without framing antitrust in a context different from the current standpoint. Antitrust exclusively serving the increase of consumer welfare and exclusively triggered by conducts harming economic efficiency is not eligible to take into account the unique competition-related problems in the agricultural and food supply chain. Criticism may be raised that curing sector-specific anomalies is not the task of antitrust, but even if it were, certain problems to be solved remain on the surface. It is also possible that these do not seem to be a problem at all from the single economic logic of antitrust, but the feature of the goods being the object of these trade relations, that is to say, their necessity for life, puts the problem in a different perspective.

In general, by looking at the full picture from a practical standpoint, it is hard, if not impossible, to find any increase in economic efficiency as the consequence of the current and mainstream paradigm of competition regulation. I am aware that there are many more factors in the background which overall contribute to the increase of food prices, such as biofuel production, energy prices, weather, speculation, economic growth and changing diets,1007 but a competition policy exclusively concentrating on economic efficiency in the form of consumer welfare does not seem to mitigate the problems. However, from an agricultural policy standpoint, it does impair important pillars of the rural landscape and lifestyle by not taking into account non-efficiency-based considerations.

The dominance of agribusiness is against the inherent values of traditional and centuries-old agricultural production. This should not be understood as a return to ancestral methods, but as support for viable farmers and family farms that are fit for the 21st century. These market actors significantly contribute to the preservation of the rural landscape and lifestyle, traditions and values foreign to the urban environment, beyond producing food. It does not seem like their exploitation by giant food companies and retail chains would bring about any tangible benefit for consumers, for example, in the form of lower prices. As a consequence of these general considerations, I propose two possible ways for the better functioning of competition in agri-food markets, which – to a certain extent – may cure the current two-component competition regimes. By two components I mean antitrust and trade regulation; the amelioration of agri-food competition is built on these two constituting elements and their interrelationship.

A competition policy, if not limited to increasing economic efficiency, can contribute to the multifunctional model of agriculture, thus by creating balance between competition and agricultural policy. A holistic and integrated view to competition-related issues of agri-food markets does not impede the realisation of the essence of multifunctional agriculture, such as “the management of renewable natural resources, landscape, conservation of biodiversity and contribution to the socio-economic viability of rural areas,”1008 but facilitates its realisation.

Small farms, though endangered by giant food companies and retail chains, play a crucial role in rural sustainability, as well as support biodiversity and ecological resilience.1009 One of the purposes of food sovereignty is precisely to express the fact that agriculture does not only consist of agricultural production as economic activity. It is much more. Food sovereignty protects the interest of future generations, empowers family farms, is committed to the three shades of sustainability (environmental, social and economic), aims to guarantee just incomes for producers, fights for biodiversity and social relations free of oppression and inequality.1010 Food sovereignty fully subscribes to the multifunctional model of agriculture and is even more than that. The multifunctional model of agriculture does not say anything about the role states should play in governing markets; the paradigm of food sovereignty, on the contrary, does.

A food sovereignty-based competition policy, on the one hand, acknowledges that agriculture cannot only be interpreted as a necessary production activity to create the ‘subject matter’ of agricultural and food trade, and, on the other hand, espouses the multifunctional model of agriculture. Moreover, it respects the way food sovereignty addresses competition in agri-food markets: the strong guardian role of the state over the competitive process with an extensive competition regulation and enforcement also leaving room for non-efficiency-based considerations. This approach is manifested in the form of legal regulation which takes into account the unique features of the agricultural sector, either through creating exemption under general antitrust rules (exception norms), or through adopting sector-specific trade regulation rules (specific norms).

22 Regulating competition in light of the food sovereignty paradigm

This chapter aims to evaluate the legal regulation in force in light of a food sovereignty-based competition policy. By food sovereignty-based competition policy I mean a mode of controlling competition in agri-food markets which takes into consideration the perceptions of the food sovereignty paradigm on competition.

Patel’s statement that the European Union is better off than the United States in terms of food sovereignty1011 is also correct regarding competition rules. According to Fairbairn, food sovereignty could provide the ambition US agri-food movements are currently lacking,1012 and the food sovereignty-based competition policy may prove to be useful for agricultural policy-makers concerned with antitrust and trade regulation in US agri-food markets.

Agricultural producers in the EU are protected to a greater extent than in the United States. While the US system does not recognise any other legitimate goal for antitrust, the EU does so but with the limitation that the primary objective is still to enhance economic efficiency. However, there are other ancillary goals which are pursued by EU competition policy. These further EU antitrust objectives leave more room for the enforcement authority to manoeuvre in the area of non-efficiency-based considerations which can be beneficial from the standpoint of agricultural policy.

From a food sovereignty approach, the EU exemption under the prohibition of anticompetitive agreements takes better account of agricultural policy, given that it requires the attainment of CAP objectives as a condition for the respective agreement to be exempted. It is missing in US antitrust. Furthermore, given that one of the CAP objectives is the raising of living standards of agricultural producers, which is also an implicit objective of food sovereignty, the EU exemption is more in line with the paradigm than the US one which is only concerned with economic considerations.

A significant difference between US and EU competition regulation is that the latter has a much more intensive protective pillar through trade regulation rules, such as the UTP Directive. The United States has even experienced that, with the appearance of the consumer welfare antitrust paradigm, the interpretation of the Packers and Stockyards Act has shifted in an unfavourable direction from an agricultural policy perspective. Recently it is rather interpreted as an antitrust statute and not as trade regulation. It means that it is much more difficult for claimants to have a violation found, for adverse effects on competition shall be proved.

All in all, the EU system of agri-food competition rules fits better with the food sovereignty’s perceptions on competition than that of the United States.

There are two alternatives for regulating competition in agri-food markets. Taken into account that the perceptions of food sovereignty on competition have been found compatible with EU competition policy, I aim to formulate my reform proposals in the context of the European Union, keeping in mind that reforms carried out at the EU level – even those which are soft law in nature – may permeate Member States’ legislation and enforcement trends.

My proposals are not formulated in connection with the previously scrutinised legal instruments but abuse of dominance and merger control, which lack agriculture-specific provisions. As I identified, the competition problems of agricultural producers do not come from there being no special rules applicable to primary agricultural production. They are created by the concentration taking place upstream and downstream in relation agricultural production.

Despite the increasing concentration of agri-food markets and the lack of abuse of dominance cases therein, these instruments currently do not serve the attainment of agricultural policy objectives. The gap identified is the inappropriate handling of buyer power from an agricultural policy perspective, which may, however, be narrowed with the review of the rules on abuse of dominance and of merger control. The legal possibility to better align them to the expectations of agricultural policy exists in EU law, taking into consideration the sufficiently broad authorisation to provide derogation for the sector from general competition rules as well as the precedence of agricultural policy objectives over competition policy.

The strength of the food sovereignty-based competition policy drawn up lies in the fact that it concentrates on one sector – the agricultural sector. Calls for a more socially sensitive and inclusive competition policy are mostly formulated in general terms, as seen earlier, applying to all economic sectors. Differently from all other sectors and public policies behind them, agricultural policy objectives – which are specific social objectives – are given priority over competition rules. The policy choice, therefore, is given, and thus the deviation from the general paradigm of competition policy in the context of the agricultural sector does not seem like a radical step. Since it is explicitly declared in the EU context that the specific social objectives of agricultural policy shall be taken into account in relation to competition policy and law, a food sovereignty-based competition policy – which is only interpretable regarding the agricultural sector – is not a profound “shock” for general competition policy. The food sovereignty-based competition policy takes a prosocial view which is in line with the starting point that competition regulation in agri-food markets shall take account of agricultural policy objectives which are social in nature.

The alternatives take into consideration, and aim to sustain, the elements of multifunctional agriculture but also provide more than that. The alternatives are food sovereignty based because they consider it important that competition be supervised and regulated under the watchful eyes of the state. If I took an approach only respecting the model of multifunctional agriculture but not the considerations of food sovereignty, the guardian role of the state would be missing. The constituting feature of food sovereignty that accepts the indirect supervisory role of the state over the competitive process through adopting the rules of the game is in accordance with the existing and influential ordoliberal competition policy. That is to say, no competition policy must be elaborated from scratch but I can insert sectorspecific considerations into a contemporary competition policy framework which, as found earlier, is suitable for that.

Food sovereignty-based competition policy means that legislation and enforcement aim to alleviate the situation of agricultural producers in the competitive process of agri-food markets. It aims to target those economic conducts which are not covered by conventional antitrust, in particular harms suffered by agricultural producers as suppliers against their buyers. The means for that are twofold: through adopting either antitrust or trade regulation rules, or both. The proposed modifications are related to those cases when producers are likely victims of buyer power abuses or misuses.

I propose that in cases related to agri-food products, be they unilateral behaviours or mergers and acquisitions, assessing the impacts the conduct may have on procurement markets and evaluating economic dependence of suppliers on buyers should play a key role in deciding the outcome of the respective case. As seen in Part IV, there are no sector-specific antitrust rules for abuse of dominance and merger control.

#### Concentrated distribution inefficiently distributes surplus, siphoning resources from producers AND cannibalizing their capital investments---that's the root cause of ag unsustainability.

Walter J. Armbruster 13, Farm Foundation, Emeritus, "Market Structure, Trade Practice Regulation, and Competition Policy," US Programs Affecting Food and Agricultural Marketing, Natural Resource Management and Policy, edited by Walter J. Armbruster and Ronald D. Knutson, Springer Science+Business Media New York, 2013, pp. 65-102

Markets for agricultural and food products have evolved from traditional spot markets with numerous buyers and sellers to a market structure dominated by ever larger farms and firms. Many transactions are now based on negotiated agreements between producers and marketing firms, or involve increased vertical contract and ownership integration or joint ventures by marketing firms into the production stage of the supply chain. This means that market transactions are:

• Often less transparent.

• Increasingly determined by prearranged agreements specified in contracts based on attributes of the product delivered.

• Frequently tied to a small base price determined by a declining number of transactions in spot markets.

• Represent payments for production services utilizing integrator owned inputs, including animals or plant seeds.

MacDonald and Korb (2011) succinctly summarize potential beneficial effects of contracts, which can help farmers manage price and production risks. Contracts are used to elicit production with specific product quality attributes, by tying prices to those attributes. They also facilitate smooth flows of commodities to processing plants, thus encouraging more efficient use of farm and processing capacities. But contracts can also have less benign effects, introducing new and unexpected risks for farmers. They increase income risk, in the event of a production shortfall, by necessitating spot market purchase by the producer to fulfill delivery commitments. Default risk comes from ties to a single contractor, leaving the producer subject to contractor failure. Finally, farmers face long-term hold up risk at contract renewal, if the initial contract does not cover the entire life of the capital investment which may be required to secure the contract (also see Key and MacDonald 2008).

While agricultural markets were originally one of the most competitive market segments and were often cited by economists as being purely competitive, change has been underway since the late 1800s. However, "Competition fails when one or a few dominant firms in an industry are able to distort prices to their advantage without competitors entering the market. Agricultural product markets are vulnerable to such failures because the products of many producers typically funnel through one or a few buyers" (Heifner, Chap. 2). This surely describes the nature of a number of agricultural markets today. It raises concerns about whether transparency in markets and information flows are sufficient to provide protections to market participants normally ascribed to competitive markets. Alternatively, does the competition between the large marketing firms provide better outcomes for sellers than would result with more firms operating at a less technically efficient scale? Otherwise, the imperfect competition characteristic of markets today may harm individual participants in ways that require government intervention to deal with market structure, conduct, and performance to various degrees.

Antitrust Laws Impacting Agricultural and Food Markets

Legal constraints have long existed to prohibit anticompetitive practices—such as purposely creating barriers to entry, colluding to fix prices and share markets, and dumping products below cost of production. Dumping concerns have been a source of contention in some sectors of the economy in recent years in the face of rapidly increasing imports into the United States, though for agriculture it is generally the other anticompetitive practices which are of most concern. The extent and vigor with which antitrust laws are enforced tends to be rather cyclical in the agricultural and food sector, perhaps driven by contemporaneous levels of consolidation activity and by political philosophy.

Federal antitrust laws, in addition to state laws, prohibit business practices which interfere with competition in order to create higher prices for products and services. The three major Federal antitrust laws are the Sherman Antitrust Act of 1890, the Clayton Act of 1914, and the Federal Trade Commission Act of 1914 (United States Department of Justice 2012).

The Sherman Antitrust Act outlaws contracts, combinations, and conspiracies that unreasonably restrain interstate and foreign trade. Agreements among competitors to fix prices, rig bids, and allocate customers are punishable as criminal felonies. The Act also prohibits monopolizing interstate commerce though anticompetitive conduct.

The Clayton Act is a civil statute—no criminal penalties involved—that prohibits mergers or acquisitions that are likely to lessen competition. It allows the US government to challenge mergers that are likely to increase consumer prices, and it requires persons considering a merger or acquisition above a certain size to notify both the DOJ Antitrust Division and the Federal Trade Commission.

The Federal Trade Commission Act prohibits unfair competition in interstate commerce, again without criminal penalties. It also created the Federal Trade Commission to police violations of the Act.

Certain segments of the agricultural and food industries have been at the heart of concerns about the balance of power favoring marketing firms over producers or impacting them because of downstream concentration. In 2010, the US Departments of Justice and Agriculture convened a first-ever jointly sponsored series of five workshops held around the country "to discuss competition and regulatory issues in the agriculture industry. The goals … were to promote dialogue among interested parties and foster learning with respect to the appropriate legal and economic analyses of these issues as well as to listen to and learn from parties with real-world experience in the agricultural sector" (Department of Justice 2010). They explored implications of consolidation in the farm input and processing sectors, as well as in food retailing. Increased coordination along the vertical supply chain was also of concern. The hearing specifically addressed seed markets, livestock markets, dairy markets, and food retailing (Balagtas 2010). The rest of this section elaborates on issues in these particular industry segments.

Seed Markets

A relatively recent phenomenon has been the emergence of the concentrated biotechnology seed industry, now dominated by a few large US and foreign firms. The industry has transformed under protection of the earlier 1970 Plant Variety Protection Act (PVPA), discussed later in this chapter, and the 1980 Supreme Court ruling in the Diamond vs. Chakrabarty case which authorized plant utility patents, providing much stronger intellectual property rights protection and allowed companies to profit from creating seeds carrying genetically modified traits. Phillips (Chap. 17) addresses issues involved in the applications of biotechnology to agriculture, including the seed industry.

Subsequent to the Chakrabarty ruling, private sector investment responded to the incentive and accelerated dramatically starting in the late 1980s (Fuglie et al. 2011, esp. Tables 1.5 and 2.3). There are two policy issues deserving attention in this vein. First does the right balance exist between current antitrust law and intellectual property (IP) law so that the benefits from added innovation outweigh the welfare losses from monopoly/monopsony pricing? The second is the antitrust issue of whether firms with current IP protection and market power are able to use it to deter entry and R&D spending by others to thereby extend their market power past the period of IP protection, or into other markets. If they can, this would reduce the benefits from IP protection and worsen the losses (MacDonald 2012).

Moschini (2010), drawing on his own and related published research, notes that the limited monopoly positions granted through patenting of seeds are critical to the willingness of the private sector to bring forth innovations such as have been witnessed in the seed industry in recent years. At.

Livestock Markets

The livestock industry, including poultry, has become much more highly concentrated in recent years. The consolidation has included some international companies taking ownership of, or forming joint ventures with, US companies. These acquisitions or joint ventures, domestic or foreign, have frequently involved competing entities and thus increased the 4-firm concentration ratio (CR4), the widely acknowledged indicator of potential anticompetitive market power. First poultry, and more recently hog production, have gone from small production units scattered over much of the United States to large scale, contract production. Contracts covered 90% of poultry production in 2008, and 68% of hog production (MacDonald and Korb 2011). Growers are basically providing labor and capital to raise the animals provided by the integrator, under contracts which specify various elements of performance for the growers and a mechanism for determining the final price paid to the grower. The capital investment commitment exposes growers to "holdup risks" from nonrenewal of contracts to fill expensive chicken production houses in rapid throughput cycles. This creates the potential for integrators to drive down payments to growers with the threat of being dropped from their producer stable.

The potential for chicken producers to go bankrupt because they are dropped, or even black-balled within the industry, due to conflict with the integrator is a significant fear. This can leave the grower unable to generate income to pay off the loans against the chicken houses they had to build to obtain the contract. The threat of bankruptcy is less for pork producers who market under production contracts because they tend to have that enterprise as one part of a portfolio of agricultural business lines. On the other hand, poultry producers are likely to be relatively small operations, without much, if any, agricultural activity beyond poultry production (MacDonald and Korb 2011).

Beef Markets

Ward (2010) noted the long history of antitrust concerns in the livestock industry, leading to the passage of the Packers and Stockyards Act in 1921. It created the Packers and Stockyards Administration in the USDA, which is now part of the Grain Inspection Packers and Stockyards Administration (GIPSA). The industry has gone through a series of different dominant firms in periodic dynamic market structural changes, driven in part by evolving technologies. The major upheaval in the late 1960s transformed the industry away from its power base in Chicago and other Midwest cities where transportation access was the initial impetus for location.

The boxed beef revolution led by upstart Iowa Beef Processors (IBP), and now Tyson Foods, reduced the importance of transportation costs for finished product to major markets. This made it feasible to locate plants near the production points, shipping the greatly reduced bulk in the form of final products to destination markets rather than transporting live animals to centralized processing facilities near those markets. The resulting economies quickly created an entirely new set of actors which then came to dominate the market for livestock and beef. Boxed beef also ushered in a new system of pricing, going from pricing a carcass to a carcass "unit" consisting of seven boxes representing a carcass.

MacDonald and Ollinger (2005) pointed to reduced packer costs from scale economies of larger plants and technology as drivers of consolidation. But they also noted accompanying or parallel changes which supported this consolidation. These included significant reduction in wages as firms struggled to reduce costs because of intense pricing competition for beef products in the face of decreasing consumer demand, and increases in size of feeding operations in Colorado, Kansas, Nebraska, and Texas, enabling them to better supply large-scale plants built in those same four states. MacDonald and Ollinger reported that by 1992, three-fourths of all fed cattle—up from one-half in 1974—were produced in these states and the largest feedlots—over 16,000 head capacity—went from producing one-fourth of all fed cattle in 1974 to 57% in 2002. The industry has been highly concentrated since the 1980s, to an extent that anticompetitive behavior and adverse economic performance are a concern (Ward 2010). Sexton (2000) pointed out the rapid escalation in the CR4 which had occurred in key food industries, including beef packing where it had climbed from 30% in 1978 to 86% in 1994.

Ward (2010) reviewed numerous studies which have identified the need to lower operating costs through economies of processing plant size because there are thin margins in both purchasing costs of cattle an.

The dairy processing industry which purchases the milk from cooperatives is also becoming increasingly concentrated. By 2008, the top 20 processors accounted for [TABLE 4.1 OMITTED] two-thirds of the milk purchases from producers and the CR4 is well above 70% in a number of major markets (Gould 2010 ) . These large processor buyers may offset any apparent market power of the large cooperatives in a number of instances.

The pricing of milk at the farm level is regulated by federal milk marketing orders (FMMO) which brings some transparency and addresses the balance between players in the industry. The extent to which this process achieves technical and allocative efficiency is an important question. The wholesale prices established in the Chicago Mercantile Exchange (CME) futures market for large cheddar cheese blocks influence prices received by farmers. This occurs through formula-based pricing and a complex classified pricing system reflecting price relationships between milk used for different manufactured and fluid products.

The dairy sector structure is totally intertwined with cooperatives and FMMO. For further discussion of dairy cooperatives, see Knutson and Cropp (Chap. 5); milk marketing orders are discussed in detail by Paggi and Nicholson (Chap. 6). The results of this marketing system in terms of prices to producers and consumers is what counts in evaluating whether the concentrated industry structure beyond the large dairy producers and plethora of smaller ones, all marketing primarily through cooperatives, is beneficial or in need of change. A number of economists have studied the industry for years and continue to do so. The results of their research provide a wide range of possible answers to these questions, based on findings in recent evaluations of cooperative market power and of the impacts of FMMO.

Chouinard et al. (2010b) argue that since FMMO raise the average price to consumers, they are as detrimental as a monopoly or oligopoly. By increasing the retail prices of fluid milk products and lowering the prices of some manufactured dairy products, they increase the average price of all dairy products and cost the average household $152.88 per year. This totals approximately $15.3 billion for the roughly 100 million US households that buy dairy products, and is an allocative efficiency loss from FMMO. Families with lower incomes or larger numbers of children consume more fluid milk than high-income households or childless couples, who tend to consume more of the higher-valued processed dairy products for which the prices are reduced under the FMMO, which are highly regressive (Chouinard et al. 2010a)

Cakir and Balagtas (2012) found that cooperatives are able to raise the price of milk purchased by fluid milk plants nearly 9% above the minimum price required to be paid under FMMO. They recognize that the market structure for milk is a sequence of oligopolistic markets, but pricing power is influenced by the combination of limited exemption from antitrust law granted cooperatives under the Capper-Volstead Act and by FMMO regulations which keep fluid milk processors from exercising market power in purchasing milk. Because derived demand for milk facing cooperatives is very inelastic, cooperatives can use their market power to obtain the markups of approximately 9% and transfer approximately $636 million from milk buyers to dairy farmers. Since retail demand for fluid milk is also quite inelastic, the resulting retail markup is less than 1%, and transfers approximately $73 million from final milk consumers to processor-retailers.

There has been some discussion of replacing the current formula pricing system for milk with a pricing system based on surveys of prices paid by manufacturing milk plants instead of tying pricing to thinly traded wholesale commodity prices (Gould 2010). However, there is currently mandatory reporting of dairy product prices by manufacturing milk plants, so there is some basis available for replacing the wholesale prices in formula pricing of milk. Further, in some local areas across the United States, a single dairy cooperative markets a very large percentage of milk under supply agreements negotiated with fluid milk bottlers that provide most milk to local retail food establishments. In short, pricing milk at the farm level is very complex, as discussed in depth by Paggi and Nicholson (Chap. 6).

Food Retailing

On the retailer end, growth in power of grocers relative to even large milk processors and other food processors/suppliers completes the imperfectly competitive, oligopsonistic/oligopolistic market structure in the food supply chain. It is widely recognized that retailers have become the dominant decision-maker in the global food supply chain in recent years. Kinsey (Chap. 2) briefly reviews the different eras of dominance of the food supply chain:

• Producers up though the 1930s.

• Food processors starting in the 1950s, creating national and international brands and employing production contracts to obtain the product characteristics they needed.

• Wholesalers evolved into the dominant force in the 1960s, as interstate highways allowed nationwide markets to emerge.

• Large regional supermarkets grew simultaneously with the wholesalers during the 1960s, and developed their own distribution centers to bypass the wholesalers.

• Supermarkets started to generate consumer data in the mid-1990s, and they have subsequently used it to develop a supply management system which gives them control over decisions affecting suppliers as far upstream as the farm level.

The driving force for the concentration which has taken place has been product differentiation to satisfy consumer demand for[TABLE 4.2 OMITTED]

Market Power and Market Efficiency

Table 4.2 summarizes the market efficiency and nonmarket impacts of the market structures discussed above, and of the antitrust policy options discussed later in this chapter, for selected sectors in the agricultural and food markets. The impact indicators reflect positive, negative, or neutral effects relative to perfectly competitive markets and current policies, respectively.

Based on research results, it is difficult to identify potential antitrust remedies to the rather weak market power most firms are able to exercise at the national level. Of course, the extent of market power appears to be much greater at the local or regional market level, especially in the livestock, dairy, and retailing sectors. The concerns at the national level include fear that potential remedies may cause greater loss of market efficiency and reduce incentives for innovation compared to tolerating the modest impacts of market power able to be successfully exercised by intermediary marketing firms.

In the seed industry, there is some level of technical or productive efficiency gained by producers from the increased returns per unit of seed input, but it is likely offset to a significant extent by the concentration levels which allow the seed companies to capture a larger share of the economic surplus than would otherwise be the case. There is an increase in allocative efficiency in this market, and the industry exhibits significant dynamic efficiency. Nonmarket benefits have decreased over the span of the biotechnology era, as rapid consolidation of the industry reduced the rural community impacts of local companies and their employees.

The beef industry consolidation has brought technical efficiency gains from lower costs of processing beef. It has caused decreases in allocative efficiency due to monopolistic competition in the concentrated markets, and possibly from environmental externalities from the larger confined animal feeding operations (CAFOs). However, the externalities may not be greater than for many smaller operations scattered more broadly across the landscape. Evidence shows that smaller operators in animal production may contribute to water quality problems, and lack financial and other resources to make environmental improvements (Abdalla 2006). This is largely a case-by-case empirical question with very difficult challenges to develop relevant comparisons. Dynamic efficiency has improved somewhat as the industry has adjusted more rapidly though supply chain modifications to deliver products more attuned to changing consumer preferences, though beef industry responses have been slower than in the pork and poultry sectors. Nonmarket beneficial outcomes have decreased as consolidation removed jobs from many communities, imposed significant public service demands on others where larger facilities located, and generally lowered industry wages to remain competitive with international producers.

For the hog and pork sector, most of the top firms in the beef industry also produce pork, though their relationships with growers are generally much more tightly vertically integrated which allows them to capture some additional production efficiencies from scale economies in transportation, feed manufacturing and marketing advantages because of more controllable live animal quality characteristics. As discussed earlier, producers have been able to partially offset the impacts of the monopolistic market structure at the packer level through production contracts to obtain somewhat higher prices and reduced price risk. These lower technical and allocative efficiencies faced by producers due to monopolistic pricing are at least partially offset by the dynamic efficiencies in the market, especially from the viewpoint of consumers who have enjoyed an abundant supply of convenient and low cost pork products. Nonmarket benefits are negative in terms of income levels and wage rates in rural communities, as in the beef case.

The existence of single buyer options for a number of poultry producers implies that growers receive lower compensation for their services than would otherwise be the case. This may lead to some growers investing less to achieve maximum technical efficiency of production in situations where the number of integrators offering contracts is small. Allocative inefficiencies exist because of the weak political effectiveness of the large and diverse set of growers versus the few contractors. However, only weak empirical evidence has been found by researchers that allocative inefficiencies are sufficient to justify stronger regulation, which is consistent with the general lack of significant regulatory response. Dynamic efficiency is evidenced by the expansion of the poultry market share vs. other meat products and the increasing variety of product offerings. Nonmarket impacts on rural communities have been negative, as in the beef and pork cases. In particular, there is ongoing concern about the environmental externalities from concentration of poultry producers near processing facilities and the corresponding amounts of manure which often exceed nearby land fertilization needs.

FMMO increase the average costs to households, and redistribute benefits among consumers of various types of dairy products—as they are designed to do. The combination of FMMO and dairy cooperatives operating together results in prices received by dairy farmers from first handler milk buyers which are higher than a competitive market would deliver. Inelastic demand at the retail level, even with a low retail markup margin, results in higher prices to consumers from processors/retailers than would occur in the absence of those entities. Thus, allocative efficiency losses occur in the dairy sector. However, there are technical efficiencies gained by producers and processors which will be partially shared with consumers though the market, depending on the price elasticity for various milk products. Dynamic efficiency has been reduced by the joint operation of the FMMO and dairy cooperatives resulting in less incentive to innovate to maintain profitability in the supply chain. Continued dairy herd consolidation has had negative nonmarket impacts on rural communities.

Retailers exercise various degrees of market power generating relatively small efficiency losses compared to the efficiency gains from coordinating market activities to satisfy consumer expectations. While supermarkets differentiate themselves in their marketing, they apparently do not fully exploit their market power in what are frequently highly concentrated regional markets. Perhaps it is to fend off potential competitors, or to avoid triggering antitrust regulatory intervention. The high CR4 ratios regionally and nationally have not fostered significant enough negative industry conduct or performance to warrant antitrust action. As in other industries where concentration at very high levels has generally been accepted by DOJ in recent years, vigorous competition among the remaining larger sized firms is expected to provide consumers with competitive prices and product choices.

However, even modest market power within the supply chain can have significant redistributive impacts between producers and food manufacturers, and between the marketing firms and consumers (Sexton 2000, 2010). Lower farm prices decrease farm level output, and food manufacturing and retail level oligopolistic market power increase consumer prices. These welfare losses overpower marketing efficiency gains to leave producers and consumers worse off overall. Technical efficiency is increased in the manufacturing and retail sectors but reduced at the farm level due to lower investment in productivity enhancing technology in the face of lower prices received. Allocative efficiency losses more than offset the overall technical efficiency gains. While dynamic efficiency is increased in the downstream portions of the supply chain, it is likely decreased at the farm level. Nonmarket outcomes are negative because lower incomes for farmers have impacts on the rural communities in which they reside.

Policies to Provide Countervailing Power and Regulate Trade Practices

A number of policies and programs facilitate farmers' ability to countervail marketing power of downstream marketing firms or provide a framework within which the agricultural supply chain operates. The extent to which the established programs are currently well suited to the marketing system which now exists deserves scrutiny. The programs have changed over time, but are seldom as dynamic as the industry itself. Regulations are normally the result of market failure to provide the level of outcome which society expects. As markets evolve, it takes some time to determine whether they are having a positive effect or are creating problems which need attention to have the marketing system satisfy the goals of market efficiency, allocating resources to the right kinds of activity to produce an outcome that approaches that of a perfectly competitive market.

At the first point of entry into the market beyond the farm gate, many producers are likely to face an oligopsonistic market structure wherein there are only two or a few potential buyers within a convenient distance. This is true even in many segments of the market in which contract sales are not the norm. USDA Economic Research Service estimates that approximately 40% of sales are now under contract, excluding production otherwise under a vertically integrated arrangement (MacDonald and Korb 2011). The weak position of producers relative to the contracting marketing firm in setting the terms of production and marketing contracts has been an ongoing source of friction within the marketing system for years. However, the size discrepancy between producer and supply chain firm is generally significant, even in the absence of contracting and vertical integration. This discrepancy is frequently the source of concerns and complaints from producers and/or the public.

A number of federal policies are in place to regulate the industry structure, proscribe its conduct or actions, and/or affect its performance or outcomes. The policies regulate trade practices; provide countervailing power for producers to offset some of the size implications and resulting oligopsonistic or oligopolistic marketing firms; or regulate industry structure, conduct, and performance. This chapter focuses primarily on programs at the level in the supply chain where local or regional production enters the processing and marketing system. Of necessity in today's marketing system, this must also consider how the retail end of the supply chain reaches back through the supply chain to impact producers' options for marketing their commodities or value-added products. This requires attention to market structure and trading practices having anticompetitive and consumer implications. The following sections address these policies and programs intended to provide countervailing power to producers and to regulate trade practices between first handlers and producers.

Countervailing Power

The Capper-Volstead Act and the Agricultural Fair Practices Act (AFPA) are intended to allow producers to work together to mitigate their relative size disadvantages in dealing with much larger marketing firms.

Capper-Volstead Act

The Capper-Volstead Act (C-V) thrust is to provide limited antitrust immunity to growers who band together in agricultural supply or marketing cooperatives under strict guidelines to jointly purchase inputs or to process and/or market their products. This provides alternative sources or outlets in concentrated market segments where firms may exercise discriminatory or harmful behavior against individual producers. The existence of some strong agricultural cooperatives, while fewer in number than earlier, indicate the continuing need for cooperatives. However, Sexton (2000) believes that this C-V tool provided to farmers—as well as marketing orders under the Agricultural Marketing Agreement Act, discussed in detail by Paggi and Nicholson (Chap. 6)—to take collective action on their own behalf has not been used very effectively in recent years. Reasons might include processor's aversion to dealing with cooperatives, processor's ability to influence producer decisions, and rivalry among a sector's larger producers rather than interest in cooperating. Knutson and Cropp (Chap. 5) discuss in detail the role of cooperatives and the C-V policy, and evaluate their effectiveness in the context of the dairy industry. In dairy, the major issues are whether greater clarification of the roles of DOJ and USDA is needed, and whether Federal Milk Marketing Orders are needed any longer. However, the same conclusions about effectiveness of cooperatives generally apply to the fruit and vegetable, as well as to the livestock, sectors.

Agricultural Fair Practices Act

The AFPA of 1967 affects integrator–grower relations. Under this law, the right of producers to decide whether or not to join together in cooperative associations is protected from interference by processing or other marketing companies. The AFPA forbids discrimination against producers who band together to bargain over terms included in marketing contracts between individual growers and marketing firms and related unfair trade practices. Coercion, discrimination, and intimidation of any kind related to persuading a grower to not join an association are forbidden. However, the AFPA does not require that a company deal with growers who are members of an association, as long as this decision is not based on membership in the association. This legislated loophole makes it virtually impossible to sustain a claimed violation of the AFPA, since a company can relatively easily claim some other lawful reason for not dealing with an individual grower (Vukina and Leegomonchai 2006b). Knutson and Cropp (Chap. 5) also discuss the AFPA and evaluate its effectiveness.

#### The entire ag system will collapse without producer empowerment.

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I. INTRODUCTION: NO FARM IS AN ISLAND

No farm is an island, entire of itself.¹ 'Agrarian exceptionalism' underlies the traditional legal understanding of agriculture. This ideological bulwark of agricultural policy is collapsing at each end of the food supply chain. Biotechnology now dominates key inputs in the production of agricultural commodities. Meanwhile, consumer preferences are driving the abandonment of many conventional cost-saving practices. Together, these sources of pressure have strengthened the grip of biotechnology companies and the retail sector over agricultural production. This irreversible loss of economic independence in agriculture has forced a fundamental re-evaluation of the human contribution to productive processes from farm to fork.

This Chapter seeks to explain these phenomena through an extended analogy to the end-to-end principle in the design of information and communications systems. It proceeds in five sections. Section II recites legal definitions of agriculture in order to demonstrate the centrality of agrarian economic independence.

Section III introduces the architectural ideal in information science, the 'end-to-end principle'. In all information platforms, intelligence arises from the ends. A necessary corollary of the end-to-end principle, however, is that physical and logical layers facilitating the transmission of intelligence contribute nothing but efficient transport. Contemporary agriculture is destined to become 'dumb pipe'.

Sections IV and V examine each of the intelligent ends in turn. Even as resource exhaustion threatens contemporary agriculture's yields, bioengineering has transferred control over critical inputs from farmers to commercial seed breeders. In turn, the accelerated evolution of pesticide and herbicide resistance spurs greater innovation in and greater dependence upon novel varieties and chemicals. For their part, bourgeois consumer preferences impose countervailing pressures \*against\* the use of certain technologies in agricultural protection. This effect is especially salient in poultry production, where state legislation has banned practices such as battery cages and force-feeding.

Section VI forecasts agriculture's economic and legal future within this end-to-end system. Despite superficially contrary attitudes toward the most intensive forms of agricultural technology, the opposite, intelligent ends in the food supply chain exacerbate the farm sector's economic vulnerability. They also bode ill for the economic prospects of farmers within a legal system that combines robust protection for intellectual property with relatively modest oversight of monopsony and oligopoly power. Agriculture is doomed to be enthralled by extrinsic forces reshaping the industry's supply and value chains, end to end.

II. THE YEOMAN'S TALE

Farming has conventionally distinguished itself, especially within industrialised societies, by its economic independence. "These large sections of the population — those who labored with their hands and those who worked the soil — were as a matter of economic fact in a different relation to the community from that occupied by industrial combinations".² The related principles that a "farmer should be his own boss" and that "land should be owned by the man who tills it" comprise the central tenet, or at least the "economic terms", of the traditional agrarian creed.³ Even more succinctly: "Farmers are independent — they can't be fired and don't work for someone else".⁴

By the same token, conventional legal definitions of 'agriculture' acknowledge the traditional vulnerability of farmers to broader economic and social forces. "Farmers were widely scattered and inured to habits of individualism; their economic fate was in large measure dependent upon contingencies beyond their control".⁵ The Capper-Volstead Act, the most important statute immunizing farmers' cooperatives from antitrust scrutiny,⁶ grew out of legislative recognition that "farmers were ... in a particularly harsh economic position".⁷ Being "subject to the vagaries of market conditions that plague agriculture generally", farmers "had no means individually of responding to those conditions".⁸ Lacking "choice about who his buyer would be and when he would sell", a farmer stood to lose a "large portion of an entire year's labour devoted to the production of a crop ... if ... forced to bring (a) harvest to market at an unfavorable time".⁹ By contrast, processors and distributors, thanks to their superior "position in the market and their relative economic strength, were able to take from the farmer a good share of whatever profits might be available from agricultural production".¹⁰

Neither agriculture nor its legal definition remains static. Although agriculture "includes more than the elemental process of planting, growing and harvesting crops", the classification of any activity as "agricultural depends, in large measure, upon the way in which that activity is organised in a particular society."¹¹ On or off the farm, "economic progress ... is characterised by a progressive division of labor and separation of function".¹² Rigid specialisation spells doom for the agrarian equivalent of the all-purpose "econowives" in Margaret Atwood's dystopic novel, \*The Handmaid's Tale\*.¹³ Unlike conventional farms, which "have to do everything, if they can", modern agricultural enterprises are meticulously "divided into functions".¹⁴

A landscape marked by fewer, larger, and more industrialised farms, once decried as a betrayal of conventional agrarian values,¹⁵ has become the norm in developed countries. 'Agriculture', once a "self-contained industry" generating "food, fuel, shelter, draft animals, feed, tools, and implements and even most of [the] clothing" for a "typical farm family", no longer has any meaningful distinction from 'agribusiness', "the sum total of all operations involved in the manufacture and distribution of farm supplies; production operations on the farm; and the storage, processing, and distribution of farm commodities and items made from them".¹⁶

As economic evolution overtakes agriculture, the law has reclassified certain functions as 'non-agricultural', "even if [such] activity is necessary to farmers and replaces work previously done by farmers".¹⁷ Shortly after WWII, the Supreme Court of the United States recognised that the "production of power and the manufacture of fertilizer are independent productive functions, not agriculture".¹⁸

Other functions remain within the economic and legal core of agriculture. Human labour and transport within farm facilities, without which "land could not be cultivated and the [crop], after harvest, would spoil in the fields and be lost", remain within the legal definition of agriculture.¹⁹ Even comprehensive, "pervasive ... control over the raising of ... chicks, the ownership of ... chicks, [the] assumption of the risks of casualty loss and market fluctuations" have not persuaded the law to regard such conduct "as agricultural activity of an integrated farmer", at least where independent contractors actually oversee the growing of poultry from hatching until slaughter.²⁰

Section 3(f) of the Fair Labor Standards Act distinguishes between 'primary' and secondary' definitions of agriculture.²¹ The primary definition "includes farming in all its branches", ranging from "the cultivation and tillage of the soil" and "dairying" to "the production, cultivation, growing, and harvesting of any agricultural or horticultural commodities".²² The secondary definition embraces "any practices ... performed by a farm or on a farm as an incident to or in conjunction with such farming operations".²³

In its most recent examination of these definitions, the Supreme Court refused to grant agricultural treatment to live-haul crews, crews who transport seven-week-old broiler chickens to slaughter.²⁴ Diverse practices, ranging from truck driving to poultry-skinning and the raising of worms for fishing bait, have fallen on either side of these legal definitions.²⁵ Generally speaking, suggestions "that agriculture has changed in the intervening" decades since the adoption of these statutory definitions have invited legislative rather than judicial reform.²⁶

In short, legal understandings of agriculture emphasise the production of food, fibre or fuel commodities as an economic function independent of upstream inputs and downstream processing. Over the course of economic evolution, conventional expectations of agrarian independence have accommodated increasing levels of external control. To the extent that food systems constitute elaborate conduits for transforming basic biological inputs into complex retail products with expressive as well as nutritional content, an examination of information platforms provides an analytically powerful analogy. The next section examines that analogy.

III. END-TO-END INTELLIGENCE IN AGRICULTURAL SUPPLY CHAINS

A. \*Ecosystem Services\*

Biologically-speaking, agriculture extracts value from ecosystem services and channels them for the specific benefit of human beings. Ecosystem services fall into three specific categories, plus a fourth foundational category, which sustains all of these other categories.²⁷ 'Provisioning' services provide direct benefits and amenities, such as water, food, fibre and fuel.²⁸ 'Regulating' services purify water and air, control pests and pollinate crops.²⁹ Of particular interest in the face of anthropogenic climate change is carbon sequestration as a regulating service.³⁰ 'Cultural' services provide humans with recreation and entertainment, artistic and scientific inspiration and spiritual meaning.³¹ 'Foundational' processes such as photosynthesis, nutrient recycling, and soil formation provide the 'supporting' services which underlie these provisioning, regulating and cultural services.³²

In the specific context of biodiversity conservation, the provisioning, regulating and cultural elements of ecosystem services correspond roughly to planetary habitat, ecosystem function and stability, and actual living organisms.³³ In turn, those organisms also follow a similar progression from physical phenotype to logical genotype and ultimately to human technologies derived from encoded genetic information.³⁴

As 'fractal' theory predicts,³⁵ the layered nature of ecosystem services pervades each facet of the earth as a living superorganism.³⁶ Unsurprisingly, agriculture as a special case of ecosystem services observes a similar structure. In order to facilitate the evaluation of agriculture as the manipulation of ecological supporting services and the conversion of ecosystems' provisioning, regulating and cultural services to human use, I examine the architecture of information and communications services. In particular, I present the 'end-to-end principle' in information science.

B. \*The 'End-to-End' Principle\*

Architecture is destiny. Although information determines much of the contemporary wealth of nations,³⁷ physical determinants of productivity retain a certain primacy.³⁸ Paradoxically, in an information-driven economy, "place has become the central organising unit ... taking on many of the functions that used to be played by firms or other organisations".³⁹

The interplay between the physical and the ethereal facilitates the flow of ideas and voluntary transactions leading to profitable exchange.⁴⁰ "Physical settings shape expressive ideas and expectations".⁴¹ Just as the settled trading rules of \*lex mercatoria\* "gave confidence and vitality to merchant communities", platforms for exchanging ideas and conducting commerce "must offer stability and predictability so that participating ... communities [can] thrive".⁴² Among drivers of economic growth, "innovation ... depends crucially" on an open market structure.⁴³ Among the different ways platforms and markets can be arranged, the "architecture that maximises the opportunity for innovation maximises innovation."⁴⁴

\*Industria est omnia divisa en tres partes\*. Like ancient Gaul and the modern natural gas industry,⁴⁵ all conduits are divided three ways between production, transmission and distribution. The creation of networks to deliver "power and light and fuel" to "ultimate consumers" demands the "Trinitarian fusing of ... three distinct operations: making, going to market, and selling in packages suitable to the needs of individual customers".⁴⁶ Every conduit consists of a physical layer, a logical layer and a content layer.⁴⁷ On top of physical network infrastructure, for instance, common logical protocols transform the Internet into "a unique medium ... located in no particular geographic location but available ... anywhere in the world".⁴⁸ These physical and logical underpinnings enable the Internet's content layer to offer "material about topics ranging from aardvarks to Zoroastrianism".⁴⁹

This tripartite structure implies 'end-to-end' design. This design principle drives all intelligence toward the edges, the where information originates and consumers respond.⁵⁰ As information approaches its intended audience, developers must be "free ... to organise lower-level network resources" in order to achieve their "design goals".⁵¹

By contrast, the goal of keeping all intervening protocols as simple and as general as possible has transformed the physical and logical conduit into dumb pipe.⁵² Although an end-to-end network becomes "stupid" by "emphasising transmission over switching", this design choice gives users control over "the vast processing power at the network's edges".⁵³ "By keeping the network simple, and its interaction general", end-to-end design has inspired applications as diverse and productive as "Internet telephony, digital music transfer and electronic commerce".⁵⁴ Dumb pipe with hyper-intelligent edges has enabled the contemporary information-based economy to spur the creative destruction of its industrial antecedents.⁵⁵

Likewise, agriculture operates within distinct physical, logical and content layers. Stockyards numbered among the "great national public utilities" that dominated the industrial era's "flow of commerce from the ranges and farms of the West to the consumers in the East".⁵⁶ Commodity trading platforms, such as Chicago's Board of Trade modulated "the flow of wheat from the West to the mills and distributing points of the East".⁵⁷ Even the production of chrysanthemums follows a three-way division of functions among breeders, self-propagators, and retail florists.⁵⁸ The production of food, fibre and fuel commodities represents yet another of the "intricate and pervasive systems which furnish light, heat, power, water, transportation, and communication".⁵⁹

At a higher level of biological abstraction, all problems of coordinated group behaviour may be evaluated according to co-operation, defection and other evolutionary dynamics.⁶⁰ The 'serial endosymbiosis' hypothesis attributes the cellular structure of eukaryotes (including mitochondria and chloroplasts in plants and algae) to the invasion of ancient prokaryotes by beneficial parasites.⁶¹ Social structures among insects reprise the evolution of co-operation: "close genetic relatives" can sometimes "reproduce more effectively if they do so vicariously, delegating the task to germ cells ... or to a queen, in the case of bees".⁶² Symbionts, such as plants and rhizobia, use biochemical tools to allocate resources (nitrogen) and prevent excessive dominance by either partner.⁶³ Information science has described itself as "scarcely more than a philosophical anticipation of ... cell theory", by analogy to "the Portuguese man-of-war" as "a complex structure of differentiated coelenterate polyps, in which relevant individuals are modified in different ways to serve the nutrition, locomotion, excretion, reproduction, the support of the colony as a whole".⁶⁴

Biological, informational and economic systems therefore communicate from end to end. They exploit structural lines that govern co-operation in all of these domains. Agriculture has always been well understood as the application of human economy to non-human biology. Recognition of the expressive elements of food adds an informational dimension and completes the analogy. I now turn to a closer examination of intelligence within agricultural production networks, first within input markets dominated by bioengineering and then within the consumer-dominated political economy of food.

IV. THE TREADMILL OF THE GODS

Agrarian loss of control over agricultural inputs assumes three distinct forms. First, resource exhaustion after thousands of years of exploitation threatens a collapse in agricultural yields. Second, the bioengineering of seeds illustrates how the manipulation of plant genomes is no longer a function performed by farmers within a process that can plausibly be considered agricultural. Finally, reliance on inputs the intensity of which ranges from that of conventional agricultural chemicals to molecular-level bioengineering has unleashed evolutionary changes that neither farmers nor agribusinesses can fully contain.

A. \*Menschendämmerung: Humanity's Twilight\*

Humanity's ecological footprint arguably warrants the re-designation of this moment in geological time from the Holocene epoch to the Anthropocene.⁶⁵ Although formal stratigraphic recognition remains elusive,⁶⁶ the idea of the Anthropocene provides a vivid reminder that human activity has profoundly affected every physical and biological aspect of earth.⁶⁷

The Anthropocene is coextensive with agriculture. "Defining the onset of the Anthropocene in terms of the initial domestication of plants and animals world-wide 11,000-9,000 years ago ... resolves the serious challenge of satisfying geological standards for establishing a new epoch in a ... compelling manner."⁶⁸ Humanity has triggered the sixth great extinction spasm⁶⁹ of the Phanerozoic Eon, a span of 542 million years, beginning with the emergence of hard-shelled animals.⁷⁰ Barely 100 species account for nine-tenths of the per capita supply of food plants around the world.⁷¹ Given the biological sparsity of the human larder, catastrophic losses of biodiversity weigh heavily on agriculture. Specific indicators, such as vertebrates,⁷² insects,⁷³ tropical forests⁷⁴ and coral reefs,⁷⁵ reveal severe declines in biodiversity.

With the salient exception of the United States, the nations of the world have committed to reducing greenhouse gas emissions so that the global mean temperature rises by no more than 2°C by 2050.⁷⁶ As much devastation as anthropogenic climate change portends,⁷⁷ "climate change is only the tip of the iceberg".⁷⁸ Beyond altering "the carbon cycle, humans are ... significantly altering several other biogeochemical cycles, involving elements such as nitrogen, phosphorus and sulphur, that are fundamental to life on the Earth".⁷⁹ Put bluntly, sheer exhaustion of basic inputs jeopardises agriculture.

The iconic instance of resource exhaustion involves petroleum. Geologist Hubbert predicted that the peak production of petroleum would signal its eventual depletion.⁸⁰ Subsequent work has elaborated "peak oil" as a singularly alarming problem for a world still hooked on fossil fuels.⁸¹ Perhaps no other phenomenon illustrates the fundamental paradox of the Anthropocene:⁸² "human well-being has reached high levels in many countries while our planetary life support system is simultaneously being eroded".⁸³

"Less well known" than peak oil "is the potential shortage of the mineral phosphorus".⁸⁴ Phosphorus plays a key biochemical role in the transfer of genetic material and energy.⁸⁵ It "is an essential element for all life forms".⁸⁶ Along with nitrogen and potassium, phosphorus is one of three macronutrients in plant fertilisers.⁸⁷ Without phosphorus, agriculture has no way to sustain current yields.⁸⁸ Indeed, the use of sulphuric acid in processing phosphate is so vital to the production of fertiliser that this application represents the primary industrial demand for sulphuric acid and for elemental sulphur.⁸⁹

Phosphorus in the form of rock phosphate is an exhaustible resource and is heavily mined for use in fertiliser production.⁹⁰ Global supplies of phosphorus are expected to peak in 2030, and to be exhausted within another 30 to 80 years.⁹¹ As global population continues to grow and especially "as diets change with the rapid development of China, India and other large developing countries", phosphorus production will probably peak before demand reaches its apex.⁹² "Without careful management of phosphorus production and distribution in an equitable and long-term manner", vulnerable parts of the world face not only "diminishing supplies of petroleum", as peak oil predicts, but also "a deterioration of food security" traceable to peak phosphorus.⁹³

B. \*The Seeds of Discontent\*

Potassium, the third plant macronutrient after nitrogen and phosphorus, is an abundant resource, mined around the world and readily recoverable from wood ash.⁹⁴ Nitrogen is even more abundant, comprising 78% of the earth's atmosphere.⁹⁵ The energy-intensive but ubiquitous Haber-Bosch process for producing ammonia⁹⁶ has nearly displaced the traditional mining of sodium nitrate.⁹⁷ Farmers too poor to afford commercial fertiliser or, perhaps paradoxically, wealthy enough to eschew synthetic nitrogen within an organic production model may still inoculate crops with rhizobia that can fix atmospheric nitrogen into the soil.⁹⁸

Symbiosis between plants and nitrogen-fixing rhizobia thus provides the backdrop for legal controversies over agricultural inputs and their economic impact on food supply chains.⁹⁹ The Supreme Court of the United States long ago recognised the significance of plant macronutrients. \*Funk Bros. Seed Co. v. Kalo Inoculant Co.\*¹⁰⁰ denied a patent for a clever but naturally occurring combination of non-mutually inhibiting bacteria for inoculating the rhizomes of leguminous plants and inducing them to fix atmospheric nitrogen in their roots.¹⁰¹

As \*Funk Brothers\* is to plant macronutrition and peak phosphorus, the 2013 case of \*Bowman v. Monsanto Co.\*¹⁰² presages peak glyphosate. This case connects the resource exhaustion and evolutionary elements of the Anthropocene with bioengineering and its distinctive impact on intellectual property.¹⁰³ \*Bowman\* is best known for holding that the patent exhaustion doctrine, which provides that "the authorized sale of a patented article" confers "a right to use or resell that article" but not the right "to make new copies of the patented invention", does not permit the saving of patented, genetically modified seed.¹⁰⁴ Decades of agrarian struggle against industrialised plant breeding¹⁰⁵ culminated in the Supreme Court's rejection of one final effort to achieve the "real objective" of being "able to save seed from a harvest", without regard to intellectual property claimed by seed breeders.¹⁰⁶

Seed-saving by farmers is a historical priority in international agricultural law and diplomacy. The International Union for the Protection of New Varieties of Plants, 1961 ('UPOV Treaty') is the first international instrument to recognise intellectual property in sexually reproduced plants. It permits signatory states to preserve the traditional expectation of farmers to save proprietary seed "for propagating purposes, on their own holdings".¹⁰⁷ Defending the "rights that farmers have to save, use, exchange and sell farm-saved seed/propagating material",¹⁰⁸ in principle, honours the supposedly "enormous contribution" by "farmers of all regions ... to the conservation and development of plant genetic resources".¹⁰⁹ This expression of agrarian independence, which emphasises farmer control over genetic inputs, is perhaps most famously embodied in Thomas Jefferson's sentiment that "the greatest service which can be rendered any country is, to add a useful plant to its culture".¹¹⁰

This romantic vision of seed-saving as the engine of genetic innovation in agriculture has no basis in economic reality. Indeed, the traditional practice of seed-saving delayed the meaningful development of a commercial seed-breeding industry. Seed-saving destroyed the ability of breeders to recoup their investment beyond a single, initial sale of germplasm from a selectively bred (let alone bioengineered) plant variety.¹¹¹

In a practical if not strictly legal sense, \*Bowman v. Monsanto Co.\*¹¹² ended any pretence as to the true nature of genetic innovation and control over genetic inputs in contemporary agriculture. It is not farmers but the agribusiness-industrial complex of seed breeders and manufacturers of synthetic fertilisers, herbicides and pesticides that dictates the invention, production and deployment of agricultural inputs.

Thanks to the rhetorical prominence and the prominent failure of seed-saving as the embodiment of the collective contribution of farmers to the development of plant genetic resources, \*Bowman\* provides the central statement of the end-to-end principle in agriculture. Monsanto had "invented a genetic modification that enabled soybean plants to survive exposure to glyphosate, the active ingredient in many herbicides (including Monsanto's own Roundup)".¹¹³ Farmers planting Roundup Ready seed could "use a glyphosate-based herbicide to kill weeds without damaging their crops."¹¹⁴

Farmer Vernon Bowman bought "commodity soybeans," which state law limited to being used for human or animal consumption rather than planting for reproductive purposes.¹¹⁵ Bowman nevertheless planted those beans. Accurately anticipating that other nearby farmers had used Roundup Ready seed, Bowman "applied a glyphosate-based herbicide" and thereupon "confirmed that ... a significant proportion of the new plants survived the treatment".¹¹⁶ He "produced in their turn a new crop of soybeans with the Roundup Ready trait".¹¹⁷

To dodge the Court's holding that he infringed Monsanto's patents in Roundup Ready soybeans,¹¹⁸ Bowman offered a "seeds-are-special argument".¹¹⁹ Asserting that "that soybeans naturally self-replicate or "sprout" unless stored in a controlled manner", Bowman argued that the bean itself, and not the farmer, "made replicas of Monsanto's patented invention".¹²⁰

Although the Court rejected this "blame-the-bean defence," Bowman's failed effort to deflect Monsanto's charge of patent infringement expressed the essence of agriculture as dumb pipe.¹²¹ When farmers "plant seeds", Bowman asserted, "they don't exercise any control ... over their crop" or "over the creative process".¹²² There is no more succinct way of confirming that Monsanto had conferred all intelligence through plant breeding and the engineering of the soybean genome. The traditional agricultural function of devising new plant varieties, extolled by Jefferson as the greatest of agrarian virtues,¹²³ has yielded to techniques in molecular biology beyond the admitted comprehension of courts reviewing disputes over their legal protection.¹²⁴

C. \*Peak Glyphosate\*

In the staggering sweep of geological time and the sheer extent of life on earth, \*Bowman\* highlights the evolutionary consequences of legal decisions.¹²⁵ The Roundup Ready soybean seed represents merely one example of the many technologies that have accelerated the treadmill on which agriculture runs.¹²⁶ Just as the Red Queen in Alice's Wonderland keeps running without seeing new terrain (because the landscape moves with her),¹²⁷ evolution routinely outpaces human intervention.¹²⁸ Although the Red Queen also stalks agriculture through resistance to pesticides¹²⁹ and antibiotics,¹³⁰ I illustrate the problem through the example of herbicide resistance.

Even as the transgenic modification of crops has reduced the use of chemical insecticides, it has dramatically increased the deployment of broad-spectrum herbicides.¹³¹ In 2013, 71% of all corn, 90% of all cotton and 93% of all soybeans planted in the United States were genetically engineered to resist herbicides.¹³²

Broad-spectrum herbicides and herbicide-resistant crops are substitutes for demoralising physical labour. Without herbicides, farmers have to remove weeds by raw force. The chopping of cotton is particularly brutal. "In order to produce a good cotton crop, cotton should be chopped in the summertime. Chopping or hoeing the weeds out of the rows of growing cotton ... is a menial, unskilled task which requires no aptitude, no training and no ability to reason".¹³³ Or in the words of James Agee: "Chopping is a simple, hard and hot job ... done with an eight- to ten-inch hoe blade. You cut the cotton flush to the ground, with a semi-blow of the blade that aches first the forearms and in time the whole spine."¹³⁴

Glyphosate presents a singularly intense concern. Monocultures consisting of a single glyphosate-resistant variety, such as Roundup Ready soybeans, invite multiple applications, season after season, of glyphosate. The resulting selection pressure gives rise to herbicide-resistant "superweeds".¹³⁵ Almost immediately after Monsanto released its Roundup Ready technology, the first cases of glyphosate resistance in rigid ryegrass (\*Lolium rigidum\*) arose in Australia.¹³⁶ Glyphosate-resistant ryegrass has now been detected around the world.¹³⁷ Glyphosate resistance has been reported in pigweed (\*Amaranthus palmeri\*),¹³⁸ or buva (\*Conyza bonariensis\*),¹³⁹ horseweed (\*Conyza canadensis\*),¹⁴⁰ Johnsongrass (\*Sorghum halepense\*)¹⁴¹ and goosegrass (\*Eleusine indica\*).¹⁴² Glyphosate resistance in common lambsquarters (\*Chenopodium album\*), a weed of special concern to cotton farmers,¹⁴³ is particularly dispiriting.¹⁴⁴

As resistance proliferates in geographic space and across biological taxa, we may soon reach, if we have not already surpassed, "peak glyphosate". From this biochemical apogee, we can foresee this herbicide's decline in effectiveness and its eventual commercial extinction. Whatever its other legal and economic implications,¹⁴⁵ the 2015 expiration of Monsanto's original Roundup Ready patent will almost certainly expand glyphosate use and the rate at which non-crop plants evolve resistance.

Superweed resistance to glyphosate has spurred the development of crops engineered to tolerate another organophosphorus compound with broad-spectrum herbicidal qualities: glufosinate ammonium.¹⁴⁶ Before the 2016 announcement of its intent to acquire Monsanto, Bayer CropScience incorporated glufosinate resistance into soybeans, cotton, corn and canola¹⁴⁷ and expanded production of the herbicide itself.¹⁴⁸

On 29 May 2018, Bayer and Monsanto entered a consent decree with the Antitrust Division of the United States Department of Justice to resolve alleged violations of section 7 of the Clayton Act.¹⁴⁹ The consent decree recognises that glyphosate and glufosinate, as "foundational" herbicides acting no selectively across a broad spectrum of plants, have no good substitutes.¹⁵⁰ Selective herbicides can supplement, but not replace non-selective, broad-spectrum herbicides as the basis of a weed management system.¹⁵¹

Monsanto and Bayer's pre-merger duopoly on foundational herbicides looms large in the consent decree that allowed their merger to proceed. Even as the decree recognises that "glyphosate and glufosinate are the only two foundational herbicides" now available to farmers, "new foundational herbicides are in development".¹⁵² Evolutionary pressure from herbicide use spurs further innovation. As the consent decree recognises, glyphosate resistance among weeds had already motivated some farmers to turn to glufosinate-tolerant Liberty crop varieties.¹⁵³ The Antitrust Division expressed concern that the merger would "eliminate competition between Bayer and Monsanto to develop next-generation weed management systems", particularly "new foundational herbicides and related herbicide-tolerant traits" in crop plants.¹⁵⁴

Because the "complex and hazardous" process of developing new foundational herbicides is not likely to "be remedied by entry or expansion",¹⁵⁵ the consent decree required Bayer "to divest all intellectual property" and manufacturing facilities "related to glufosinate".¹⁵⁶ Bayer was also required to divest "pipeline" projects on "new herbicides and new traits that confer tolerance to those herbicides", including the non-selective herbicides, ketoenole and N,O-chelator (NOC) as well as isoxaflutole, a selective herbicide blended with glufosinate in Bayer's Balance Bean product for soybeans.¹⁵⁷ BASF "is the only buyer" that the Antitrust Division deems "suitable to resolve the range of competitive concerns raised by the merger", which encompass issues beyond those raised by foundational herbicides and crop varieties bioengineered to tolerate them.¹⁵⁸

D. \*Transcending the Transgene\*

Finally, the advent of CRISPR/Cas9 gene editing promises to revolutionise the legal framework for regulating bioengineered organisms in agriculture.¹⁵⁹ Although this subject warrants book-length treatment in its own right, a single example foreshadows the coming eclipse of transgenic technologies and the legal tools used to regulate them.

Enzymatic browning through oxidation by polyphenol oxidase ('PPO') is a common reaction in fruits and vegetables.¹⁶⁰ It represents a major problem in the fruit processing industry.¹⁶¹ Finding no significant environmental impact, the United States Department of Agriculture ('USDA') has granted preliminary, non-regulated status to apples engineered to resist PPO.¹⁶² The gene silencing of PPO, in so-called Arctic Apples, applied RNA interference ('RNAi') technology that the USDA had already approved to suppress acrylamide levels in potatoes.¹⁶³

These technological and legal antecedents supported the USDA's decision to grant non-regulated status to transgene-free, CRISPR/Cas9-edited white button mushrooms (\*Agaricus bisporus\*) whose genome has undergone small deletions to silence a specific PPO-related gene.¹⁶⁴ Whereas the use of RNAi in potatoes and apples had relied on non-parent genetic material, the editing of mushrooms through CRISPR/Cas9 introduced "no foreign DNA ... into the mushroom genome".¹⁶⁵

Non-regulated status for this edited mushroom heralds two significant changes in agricultural biotechnology. First, the gene-editing relied entirely on the mushroom's own genome, without there being any reliance on exogenous genetic material. Second, the suppression of PPO-driven enzymatic browning produced a notable improvement in food quality at the consumer level. In stark contrast, the plant-incorporated protectants and herbicide-tolerance traits that have been the subject of earlier transgenic modifications have provided mostly production-level economic benefits to farmers.

The story of agricultural inputs in the Anthropocene epoch emphasizes forces well beyond the economic control of farmers. From fossil fuels to plant macronutrients, resource exhaustion stalks contemporary agriculture. Bioengineered solutions against weeds and insect pests have rapidly accelerated the evolutionary treadmill on which the industry runs. The emergence of advanced technologies that are not dependent upon the introduction of foreign genetic material also heralded a shift from farmer-centred engineering to direct consideration of consumer welfare. This Chapter therefore examines the final leg of the food value chain, where an altogether different form of intelligence arises – intelligence from the formation of consumer preferences.

V. SIGNAL, SOUND AND FURY

At the opposite end of the food value chain, consumers have attached ever greater significance to agricultural issues that are essentially symbolic or expressive. In Barnhill's succinct formulation, many controversies involve "the symbolic value of food choice".¹⁶⁶ These controversies often point in the opposite direction to concerns over resource exhaustion. They represent the triumph of informational commitments and social signalling interests both of which are far removed from the economic profitability or even the viability of agricultural producers.

The opposite ends of the food value chain in affluent societies, especially in Europe and within certain niches of the American market, do share some antipathy toward bioengineering. Labelling food according to its compliance with organic production standards (including avoidance of genetically modified organisms) may be the most salient of these issues.¹⁶⁷ Act 120 in Vermont, which requires labels to disclose whether food has been produced entirely or in part through genetic engineering, may export a single state's labelling policy to the rest of the country.¹⁶⁸ If only as a matter of temperament, consumer resistance to bioengineering reflects a deep conservatism. It "stands athwart history, yelling stop".¹⁶⁹

The category of symbolic battles over food, however, spans terrain far beyond organic production and the use or avoidance of genetically modified organisms. The food fights of the comfortably fed routinely involve struggles to control expressive or symbolic terrain, far removed from the ecological merits or demerits of Anthropocene agriculture. The metaphysics of consumption overrides the nutritional value of food and the cold equations underlying the ecology and the economics of agricultural production.

We can draw lessons from a failed effort to regulate retail coffee sales in Berkeley, California.¹⁷⁰ A 2002 referendum would have required all coffee sold within the city to be brewed from beans certified organic, fair-trade, shade-grown, or some combination of any of those traits. Organic production aspires to a vague hope that avoidance of synthetic pesticides and fertilisers can "foster a cycling of resources, promote ecological balance and conserve biodiversity".¹⁷¹ Fair trade certification seeks to reorder the economics of agricultural production. Ideally, the elimination of intermediaries within the supply chain minimises opportunities for exploitation by agribusiness purchasers and enables coffee producers, who often live in developing countries, to obtain greater profits.¹⁷² For its part, shade-grown coffee embodies ecological ambitions in agroforestry, insofar as growing coffee under a biodiverse canopy outperforms coffee monocultures on unshaded plantations along multiple ecological measures.¹⁷³

All three of these aspirations have their virtues and limitations. Combining them, however, exposes a certain logical incoherence. Fair trade certification's labour-oriented objectives, specifically the redirection of economic surplus from supply-chain efficiency toward higher returns on agricultural labour, have no connection to shade-grown coffee as a form of permaculture or to organic production's wider ecological ambitions. "Slave of the wheel of labour, what to him / Are Plato and the swing of Pleiades?"¹⁷⁴ Instead, the freedom to choose among these three forms of non-conventional coffee cultivation performs the expressive function of protesting less virtuous methods for growing or distributing coffee. "Drinking our elixir makes you virtuous. Drinking any other swill makes you vile".¹⁷⁵ In his \*Theory of the Leisure Class\*, Thorsten Veblen recognised that the "honorific" consumption of "more excellent goods is an evidence of wealth" and "conversely, the failure to consume in due quantity and quality becomes a mark of inferiority and demerit".¹⁷⁶ More modern, and more cynical, observers might characterise this behaviour as 'virtue signalling'.¹⁷⁷

Internal inconsistency likewise characterises controversies over milk from cows treated with recombinant bovine somatotropin ('rbST').¹⁷⁸ This bitter contest has devolved into a stalemate, as federal appellate courts have banned not only forced disclosures of rbST use,¹⁷⁹ but also state-law prohibitions of voluntary labelling by farmers who have elected not to treat their cows with rbST.¹⁸⁰ Consistent with its broader policy that food vendors may not label their foods as "GM free" or "biotech free" unless they simultaneously disclose that foods so labelled are neither safer nor nutritionally superior to unlabelled foods,¹⁸¹ the United States Food and Drug Administration requires milk touting its origin as being from cows that have not been treated with rbST to disclose that "no significant difference has been shown between milk derived from rbST-treated and non-rbST-treated cows".¹⁸² The resulting legal equilibrium is as unhappy as it is stable.

Prohibitions on foie gras¹⁸³ are arguably even more acute in their castigation of non-compliant consumers. If you eat foie gras, so the logic goes, you condone the force-feeding of ducks or geese. Again, there is no intrinsic demerit in opposing gavage as a matter of law and business ethics. Short of adopting a strictly vegan ethos,¹⁸⁴ the law tolerates animal slaughter.¹⁸⁵ At the same time, the law recognises gradations of decency.¹⁸⁶ The general right to kill animals does not necessarily subsume a specific right to engage in an agricultural technique that a democratic majority may find abhorrent. Little wonder that even the European Union is divided: foie gras, a staple in French gourmet cuisine, now violates German law.¹⁸⁷ Other jurisdictions have banned other food items, such as eggs from hens confined in battery cages¹⁸⁸ and shark fin soup,¹⁸⁹ on the basis of moral objections to the treatment of animals used in their production.

Labelling controversies effectively treat conventional coffee and milk as food taboos. Outright bans on foie gras, battery cage eggs and shark fin soup go even further by removing entire categories of food from lawful diets and, consequently, forbidding practices leading to the production and sale of taboo foods. "Prohibitions on eating certain foods" have arisen across cultures throughout human history.¹⁹⁰ Such taboos almost invariably arise from belief in "negative magic".¹⁹¹ Rules of sympathetic magic dictate that contact with disgusting objects constitutes permanent contamination and that visual similarity constitutes qualitative equivalence.¹⁹² Because, food that touches a cockroach is repulsive, so is otherwise wholesome food that has been crafted to resemble a cockroach. The principle \*juxta hoc, ergo propter hoc\* (near this, therefore because of this) is "characteristic of mythical thinking", which "treats every contact in time and space as an immediate relation of cause and effect".¹⁹³ Consistent with the view that law must "curb certain natural propensities" and "control human instincts",¹⁹⁴ modern (and modernist) sentiment counsels "the removal of ornament" from food items as "utilitarian objects".¹⁹⁵

Lest food taboos prohibiting resort to "many animals and plants, wholesome enough in themselves", be dismissed as "superstitions of the savage",¹⁹⁶ contemporary behavioural science recognises the persistence of superstition and magical thinking, even among educated and emotionally stable adults.¹⁹⁷ Food taboos, which range from seasonal limitations such as Lenten avoidance of meat and Mormon prohibitions on coffee, tea, and alcohol, to comprehensive rules prescribing kosher or halal practices, give meaning to religions commanding hundreds of millions of adherents worldwide.

Ultimately, the objectives of consumer-oriented intelligence at the end of an affluent society's food value chain must be understood as being more akin to religion than to science. Certainly, nothing in legislation banning foie gras or battery cage eggs approaches the rigour with which the Food, Drug, and Cosmetic Act, 1938 ('FDCA') demands that all new human drugs be "safe and effective".¹⁹⁸ Food derived from genetically modified organisms, including dairy cows treated with rbST, is not "adulterated", as that word is understood by the FDCA.¹⁹⁹ If such foods were determined unfit for human consumption, the appropriate remedy is not disclosure coupled with faith that self-preserving instincts among consumers will prevent harm to public health. Items "unfit for food" should not enter the stream of commerce in the first instance.²⁰⁰ Adulterated products in commerce may be seized and condemned.²⁰¹

If anything, labels purporting to communicate the absence of genetically modified organisms flirt dangerously with the FDCA's prohibition against the misbranding of food.²⁰² This prohibition protects consumers against false or misleading advertising.²⁰³ It is one thing to convey a system of belief or ideology through the signals that food labelling sends. At the threshold where food labels mislead or even convey false information, regulatory intervention becomes appropriate.²⁰⁴ Claiming greater safety or nutritional superiority for foods not derived from genetically modified organisms crosses that line. Symbolic and expressive interests at the end of the food value chain need not heed the strictly scientific standards that govern the introduction of bioengineered inputs at the head of that chain. But, false and misleading claims command no respect in other branches of law. Such interests deserve no greater traction within the law of food.

VI. AGRICULTURE END-TO-END AND THE END OF AGRARIAN INDEPENDENCE

Driving all intelligence in the agricultural supply chain to its ends, where biotechnology reinvents basic inputs amid natural resource exhaustion and the other at which consumer tastes dictate practices on the farm, compels a fundamental re-evaluation of agriculture's legal and economic premises. As price-taking suppliers within structurally competitive commodity markets, farmers can expect to pay ever-rising premiums for basic chemical and genetic inputs. At the same time, virtue signalling among affluent food consumers places legal pressure upon cost-saving practices (such as battery cages in egg and poultry production) and entire lines of profitable production (such as foie gras).

From the perspective of conventional agricultural policy as the client politics of industrial favouritism,²⁰⁵ the transformation of farmers into economic "dumb pipe" within an end-to-end platform spells doom for longstanding legal goals. Among the things that children learn on a farm, the following lesson may be the coldest: "you learn that things die. You will never belong on a farm until you learn this".²⁰⁶ Pigs, pets and pests routinely die. As do entire economic systems. Modern agribusiness peals the bell of economic progress in multiple ways, from exhaustion of phosphorus to peak glyphosate and the bourgeois virtue signalling of affluent food aficionados. Farmer, "never send to know for whom the bell tolls; it tolls for thee".²⁰⁷

Intelligence at the opposite ends of contemporary agriculture's informational conduit has had its most profound impact on entirely different forms of farming. The arms race against the exhaustion of macronutrients and the anthropogenically-accelerated evolution of insects and weeds tends to take place within the plant kingdom. For their part, many of the most bitter, consumer-driven controversies over the ethics of food have involved animal-derived products such as milk, eggs and goose liver. In other words, growth in intelligence within agricultural inputs tends to emphasise basic commodities, especially within the plant kingdom, while the consumer-driven expressive function of food resurrects atavistic food taboos in a nominally secular society. These tendencies, which reflect the greater amounts of energy consumed in the production of foods derived from animals,²⁰⁸ are consistent with the suggestion that a Kuznets curve characterises the path of environmental quality as economies develop.²⁰⁹

The opposite terminals of agriculture, end-to-end, also reflect critical legal differences. Laws conferring intellectual property in bioengineered germplasm and permitting its introduction into the environment enjoy the tailwind from the United States Constitution's substantive endorsement of innovation,²¹⁰ as embodied in the patent and copyright clause's stated aspiration to "promote the Progress of Science and useful Arts".²¹¹

By contrast, downstream segments of agriculture, end-to-end, reflect weaker legal arrangements for agrarian interests. Antitrust doctrines protecting farmers against oligopsonies or monopsonies in purchasing markets are notoriously underdeveloped. Although the Supreme Court has recognised "monopsony power [as] market power on the buyer side of the market"²¹² and paid some heed to the leverage that agribusinesses hold vis-à-vis the farmers whose output they buy,²¹³ excess purchasing power remains one of the weakest links in American competition law.²¹⁴

Insofar as injury to agrarian interests takes the form of state and local legislation enforcing the moral and aesthetic food preferences of affluent consumers, the legal doctrine again treats farmers as dumb pipe within the food value chain. State actors are generally immune from federal antitrust liability.²¹⁵ This immunity extends to local governments as long as they act according to a "clearly articulated and affirmatively expressed" policy under state law that directs the suppression of competition.²¹⁶ Though the dormant commerce clause does impose powerful discipline on state and local legislation, that doctrine is designed to vindicate the federal interest in free trade, not the narrower client interests of agricultural producers.²¹⁷ Local laws banning foie gras, battery cage eggs and shark fin soup routinely prevail over federal constitutional and statutory challenges.

Perfect predictions are the one promise that agricultural policy can never credibly make. As a subject of legal regulation, agriculture is "so vast that to fully comprehend it would require an almost universal knowledge ranging from geology, biology, chemistry and medicine to the niceties of the legislative, judicial and administrative processes of government".²¹⁸ This Chapter's description of agriculture according to the end-to-end principle in the design of information systems cannot escape the qualification that no model can achieve exactitude in science.²¹⁹ "All models are wrong; some models are useful".²²⁰ In a world where the ghost of Malthus still walks²²¹ and food security wobbles amid the vagaries of the Anthropocene,²²² humanity would be wise to hedge its bets.

#### Specifically, from monocultures, warming, NOx, pesticides, fertilizers, and runoff---empowering end producers solves.

Imaan G. Mohandessi 25, Researcher at Regis University, "How Do We Make U.S. Agriculture More Sustainable? Balancing the Needs of Earth and Humanity," Thesis, Spring 2025, https://epublications.regis.edu/theses/1169

Agriculture is pivotal to civilization; the ability to cultivate a consistent and reliable food supply allows populations and communities to grow. However, the previous case studies I have examined focused on the development of ancient agriculture, rather than what has been happening in modern agriculture. I will now shift my focus to America to understand the development of modern agriculture. In the first chapter I consulted historical records and archeological data to examine the important agricultural innovations that allowed humanity to dominate the Earth, emphasizing how the environment is a limiting factor that influences agricultural practices and how human innovation allowed us to surpass these environmental limiting factors. In the rest of my thesis, I will reorient towards the U.S. agricultural system and sustainability. Throughout the rest of this thesis, I will demonstrate how the current U.S. model for agriculture is unsustainable and environmentally degrading and answer the question of how the U.S. can transition the current model of agriculture to more sustainable alternatives.

In the United States, we currently implement a monoculture-based agricultural system, but this is only a recent change in the United States. Before the United States was a country it used to be a collection of thirteen colonies that were owned by the British Empire originating on the eastern coast of North America, and before that Indigenous people populated the Americas (McAllister, 1989). While the British Empire was founding the colonies in America, it had little hope that it would be a fruitful endeavor. At first glance the thirteen colonies appear to be an unwise economic venture because there seemed to be few exploitable resources, such as precious metals like gold and silver, and Indigenous peoples were uncooperative with European settlers (McAllister, 1989). However, contrary to initial predictions the English colonies started to grow and flourish with a thriving economy and advanced civic engagement in many spheres of life such as religion, trade and commerce. There are many reasons why the British American colonies were so popular to immigrate to, but the most common reasons to move to the colonies was to escape religious and social pressures. Many people fled to America to freely practice their own religious beliefs, but one of the main factors in migration was economic opportunity (Hansen, 2014). The colonies had favorable conditions for agriculture and had animals whose pelts were valuable and highly sought after in Europe. Trade in agricultural goods and pelts allowed the British American colonies to generate exports to Europe in exchange for European manufactured goods such as tools, utensils and firearms (Chambers, 1938). The growing colonial economy was able to establish a high enough standard of living along with ample economic opportunity, and the British American colonies were able to rapidly grow from European immigration (Chambers, 1938).

In pre-industrial British American colonial society, 80 percent of jobs contributed to the agricultural sector (Chambers, 1938). Colonists cultivated both new- and old-world crops. European vegetables, grain, and fruit staples such as citrus fruits, were grown throughout the colonies. Another essential aspect to agricultural development in the early colonies was the incorporation of livestock, such as cows, horses and pigs, because the new world did not have many native species that were cultivated for food purposes (Chambers, 1938). Livestock animals first introduced by European colonizers are one of the most important aspects of agriculture to this day because of how reliant the U.S. is on livestock production. Combining these old-world products with indigenous new world crops, corn and tobacco being the most important, led to diverse agricultural products in the colonies. The economic system of the colonies therefore was an agriculturally focused system, with the goals of feeding families and exporting surplus products back to Europe (Lemon, 1987). Farmers in the northern colonies tended to cultivate a diverse and dependable crop to feed their families, using long fallow as a basis for their agricultural system. Because of the emphasis on smaller scale agriculture in the northern colonies, there was relatively little commercialization compared to the Chesapeake Bay and the Carolinas (Lemon, 1987). Large-scale agriculture within the southern colonies focused on cultivation of cash crops like tobacco and cotton to maximize profits since better weather conditions in the Midwest and southern portions of the colonies was more ideal for cultivation of crops at a large scale. Northern colonies based most of their economy on trade as they were closer to Europe than other colonies.

The general economic trend of large-scale agriculture in the Midwest and South and industrialization and urbanization in the North continued after the colonies won independence from the British Empire. The economy of the northern states incorporated agriculture but was generally much more focused on fur trading and ship construction (Lemon, 1987). Southern and midwestern states, on the other hand, were a hub for agriculture. Plantations that used slaves as a labor force were common in these regions, as their economy was based on large-scale agriculture focused on generating the largest yields of crops, with cash crops like tobacco and cotton being the most popular crops to cultivate (Post, 2003). In the middle states cash crops such as tobacco were still popular to cultivate, but there was a greater emphasis on more food products such as grains like wheat and barley. The hot and humid climate of the southern states made it ideal for the cultivation of cash crops. Cash crops in the United States are tobacco, rice, and cotton, and the cultivation of such products was a very labor-intensive process that required lots of land and many laborers, and the United States and the other colonial powers at the time used slave labor to make the most profit (Post, 2003).

The North Atlantic slave trade allowed European empires to kidnap and enslave the native populations of their colonies. The North Atlantic slave trade was a triangle, with Britian, the United States, and African colonies being the key players. Britain exploited the indigenous population of their African colonies for free labor, and plantation owners living in the American colonies bought these slaves so they could maximize the profits from selling cash crops without paying for labor (Post, 2003). Slavery is a terrible practice that is morally wrong and causes much suffering and hardship throughout history. The crops produced on these plantations by slave labor were sent back to Europe as raw materials for industrial products. In Europe the demand for raw materials dramatically increased due to rapid industrialization in response to demand for manufactured goods.

Western industrialization heavily focused on Europe and its colonial powers. In Britain the industrial revolution is linked with the Seven Years’War between the British and French imperial powers. Britain and France were fighting to see who the major colonial power in the Americas would be, and in 1815 the English defeated the French and became the dominant colonial power in North America (Clarke, 2008). This increase in military power along with technological advancements were the driving factors in industrialization on a global scale. The mechanization of production allows for more efficiency when developing products, thus generating a larger number of goods faster leading to increased profits. The specific technological developments that drove industry in Britain were developments in iron and steel products, and the most important improvement was in cotton textile development (Clarke, 2008).

The United States, along with most other colonies under imperial rule contributed to industrialization by producing raw materials. When the Industrial Revolution was in its beginning phases, the United States still employed slave labor to cultivate cash crops and other tasks. While tobacco was the original cash crop that was most cultivated in the American colonies, that did not stay the case. Cotton became the most valuable export from the United States to Europe due to the innovations in textile production that demanded access to cotton fibers (Clarke, 2008). This demand for cotton only increased as time advanced because of cotton’s cheap price it was easy for manufacturers to use to mass produce textiles. While cotton played a crucial role as an export for the United States, there was much more industrialization outside of cotton. The Industrial Revolution lasted for a 150-year period starting in the mid-eighteenth century, and was defined as a period of rapid technological, economic, and social development that launched the United States from a pastoral society to industrialism (Tinerella & Radcliff, 2005). The industrial revolution was defined by a few key technological developments that allowed for more efficient travel and commerce within the United States and internationally. These crucial technological developments were the invention and incorporation of steam engine power, the creation of railways, and an increased reliance on manufacturing to process goods, such as the cotton gin and power loom in textile manufacturing (Tinerella & Radcliff, 2005). These technologies allowed the United States economy to grow and flourish and were the main driving force behind westward expansion. Westward expansion, driven by the philosophy of Manifest Destiny, was the encroachment of the United States on Native American lands that led to the massacre and displacement of Native American peoples (Wisley, 2018). This westward movement by the United States reflects the growing need for more land. With the continued flourishing economy of the Industrial Revolution, the demand for cotton and other raw goods increased. To try and match the increasing material demands of European manufacturing, the United States purchased land to the west to increase its agricultural output (Wisely, 2018). In the process of moving westward, settlers displaced the native peoples who lived in that land and subjected them to cruel and inhuman treatment (Wisely, 2018). Railroads played a crucial role in this westward expansion because of how efficient they made travel. Railroads were hubs of movement that allowed the transportation of goods and people over great distances in a relatively small amount of time. They allowed products and goods cultivated in the west to be quickly moved to the eastern coasts to be shipped off to mainland Europe.

The U.S. continued to operate on this economic model for some time, however after the end of the American Civil War in 1865, slavery was abolished from the United States (Ochiltree, 2004). This posed a very large problem for the southern states because the slave labor that plantations had been relying on could not be continued. Suddenly plantation owners had to find a new labor system to continue crop cultivation. What emerged was a switch to sharecropping, where landowners leased out their land in smaller plots for farmers to work (Ochiltree, 2004). Sharecropping was most popular in the south where white landowners used this system to oppress recently freed slaves by limiting and controlling the resources that the leasers could use. The landowner took most of the crops grown on the land and only left a portion or share of the crop for the leasing farmers to use (Ochiltree, 2004). This period also witnessed the beginning of commercialized farming, with multiple farmers who worked on smaller sections of land producing a harvest that was collected by the landowner. But as time passed and the world continued to industrialize, a shift toward commercialized agriculture occurred, and this is particularly evident during the global movement called the Green Revolution.

The Green Revolution was a global movement during the 20th and 21st centuries that focused on increasing agricultural output (Patel, 2013). The discovery and use of agrochemicals like pesticides and synthetic fertilizers, and the development of high-yield crops was crucial to increasing agricultural productivity during this period (Stone, 2019). Countries began to use high-yield crops during this time; in Asian counties short-grain wheat and rice became increasingly popular while the United States focused more on corn. High-output crops and agrochemicals together paved the way for the agricultural system in the United States to focus on farming in monoculture. Monoculture is the agricultural practice of growing a low number of highly specialized crops such as corn and wheat with the goal of producing the highest yield possible.

Agrochemicals and monoculture have been the cornerstone of the Green Revolution because they allowed us to cultivate land that was previously thought to be unusable (Pelinson, 2019). There are two major groups of agrochemicals that were widely popularized during the Green Revolution, fertilizers and pesticides. While fertilizers increase nutrient availability in soil to increase the number of crops grown, pesticides defend crops against small pests such as insects and weeds to prevent crop loss (Grandara et al., 2024). These agrochemicals are a cornerstone of modern agriculture today, because agrochemicals allow us to maximize output. One of the major threats to monoculture is limited diversity in crop selection, which causes the crops to be more sensitive to pest disturbance (Grandara et al., 2024). To combat this relative weakness, pesticides were applied extensively to kill off any pests that threatened crop yields. The development and widespread implementation of agrochemicals was critical in developing the modern U.S. agricultural system of intensive monoculture. This system relies on the principle of controlling environmental conditions to create the largest possible yield of a few staple crops.

The biggest reason why pesticides and other protective agrochemicals negatively impact the environment is because these chemicals are toxic. Protective agrochemicals use chemical ingredients to eliminate pests, but these chemical ingredients can also be toxic to other living organisms (Tudi et al., 2021). Because pesticides are non-specific in their targeting mechanisms, they are a major threat to biodiversity on agricultural land and in neighboring ecosystems. Another issue with pesticides is how difficult it is to minimize their area of impact. Pesticides have the potential to linger in an environment or transfer to nearby environments, which often results in either environmental or human exposure to these toxic chemicals (Tudi et al., 2021). This is very troubling because exposure to agrochemicals causes health problems for humans. The combination of pesticides being non-specific with their mobility in the environment is the reason why pesticides are so deadly to biodiversity. This results in pesticides leaching out of agricultural land and into the surrounding environment and threatening biodiversity in ecosystems where they were not initially applied. Overall, when it comes to pesticides, our current system is dependent on their usage to support the current crop yields. In the current monoculture model without the use of pesticides, there would be a 78% reduction to fruit production, 54% loss of vegetable production, and 32% loss of cereal production (Tudi et al., 2021). However, that still doesn’t change the fact that agrochemicals damage the environment, lower biodiversity, and cause health problems because of their toxic nature.

Pesticides are an important innovation in agricultural technology that humans use to combat pests, but they are not the most important innovation. The most important agrochemical is synthetic fertilizer which increases the nutrient content of soil such as nitrogen. Availability of soil nitrogen, an essential element for plants, ultimately limits crop growth and production. Although nitrogen is available in soil, farmers frequently amend soil with nitrogen-rich fertilizers to increase crop yields. But this heavy reliance on fertilizers negatively impacts the environment by ultimately polluting the environment. The extensive use of nitrogen fertilizers in crop production increases reactive nitrogen soil emissions to the atmosphere substantially (Ma et al., 2022; Galloway et al., 2021). Biological processing of reactive nitrogen components in fertilizer is one of the main sources of greenhouse gas emissions like nitrous oxide from the agriculture industry (Ma et al., 2022). Heavy reliance on nitrogen fertilizers causes air pollution which negatively affects human health but also degrades the environment. While the overapplication of nitrogen fertilizers causes atmospheric pollution, so does its production. Fertilizer production accounts for approximately 1.2% of the world's energy, 93% of which is consumed by nitrogenbased fertilizers (Stanford, 2014). Energy from other fossil fuel sources is needed to provide the energy requirements of generating synthetic fertilizers, which in turn causes environmental pollution from greenhouse gas emissions. So, synthetic fertilizers, specifically nitrogen-based fertilizers, are a major source of air pollution because synthetic fertilizers release large quantities of reactive nitrogen compounds when applied at high concentrations and excess greenhouse gas emissions when generating synthetic fertilizers (Galloway et al., 2021).

While nitrogen fertilizers are a crucial tool for maintaining high production in the agricultural industry, they are overused in the current agricultural model which leads to environmental damage. The reason that the U.S. agriculture industry needs to rely so heavily on nitrogen fertilizers in large-scale monoculture is to provide enough nutrients to have high crop yields. Monocultural systems are only possible through the intensive application of agrochemicals, which in turn lead to major environmental costs, such as reduction in soil nutrients, water eutrophication and air pollution (Arrobas et al., 2016). These environmental costs are common across all large-scale monocultures. Runoff from snow melting or excess rainfall removes nitrogen from agriculture fields and deposits it in the surrounding environment, and this is more often observed in areas that over apply fertilizers (Silva et al., 1970). This runoff causes great environmental damage, especially through eutrophication of local water sources. Eutrophication is the process in which limiting nutrients like nitrogen enter a body of water, causing rapid algae growth. This excess algae growth limits light which results in algae death and oxygen depletion from aquatic environments due to heterotrophic bacteria consuming dead algae ultimately leading to massive animal deaths and loss of biodiversity (Kahn, 2014). This is a common issue in the monoculture system because of how frequently overuse of agrochemicals happens.

To properly apply fertilizers, farmers must understand the nutrient requirements of their crops and the soil health. Ideally one should conduct an evaluation of site environmental concerns, evaluate soil nutrient availability, calculate nutrient application amounts based on realistic crop yields and available soil nutrients, and apply appropriate nutrient concentrations to just meet crop demands to maintain environmental health (Noor-E et al., 2015). While this is the ideal case scenario when applying fertilizers, it isn’t commonplace because of how intensive these surveys are (Noor-E et al., 2015). Instead of spending a large amount of time and money on land surveys to properly manage agricultural land, it is a lot easier and cheaper to buy excess fertilizers and overuse them. So, fertilizers are a large source of pollution and environmental degradation because of their overapplication. When used in high concentrations nitrogen moves away from target crops and moves into the environment at large. This movement of nitrogen throughout the environment causes pollution and degrades terrestrial and aquatic ecosystems. While synthetic fertilizers are still needed in our agricultural system, there needs to be a change in how we use nitrogen fertilizers to lessen the environmental impact of the agricultural industry

As I have illustrated throughout this thesis so far, the development of agriculture and its continued innovation has allowed the human population to increase massively. The increase in the human population in the 20th century would not have been possible without a parallel increase in food production (Tudi et al., 2021). But this massive growth has not come without its drawbacks. Until now I have focused on the negative impacts of agrochemicals on the environment, and how our overreliance and application of synthetic agrochemicals degrades the environment and negatively impacts human health. One consequence of the current agricultural practices in the United States that hasn’t been explored yet is climate change.

Climate change is a widely discussed and debated issue during these times. The UN defines climate change as “long-term shifts in temperatures and weather patterns which can be natural, due to changes in the sun’s activity or large volcanic eruptions. Since the 1800s, human activities have been the main driver of climate change, primarily due to the burning of fossil fuels like coal, oil and gas” (United Nations, 2024, p. 1). This new wave of climate change is due to humans’ continued reliance on fossil fuels which emit greenhouse gases. These greenhouse gases, like carbon dioxide (CO2) methane (CH4), and nitrous oxide (N2O) efficiently trap energy from the sun and re-emit it as heat within the atmosphere. These greenhouse gases are crucial to maintaining stable temperatures and sustaining life on Earth (United Nations, 2024). However, humans have increased the concentration of greenhouse gases with our reliance on fossil fuels. Our reliance on fossil fuels is quite evident when our emissions have grown rapidly since the 1950s. In 1950 the global carbon dioxide emissions total was 5.93 billion tons, but that number has dramatically increased since then with global emissions totaling around 37.79 billion tons (Ritchie et al., 2023). This drastic increase in greenhouse gases has very real consequences which include changes in temperatures, precipitation, and more frequent extreme weather events which negatively affect agriculture (Rose & McCarl, 2008). These changes are detrimental to humanity as increasing temperatures cause longer and more frequent droughts along with increasing frequency and intensity of storms. These changes have led to more of the earth being uninhabitable for human life, a consequence that will intensify as the years pass by.

What role does agriculture play in the battle against climate change? Agriculture is one of the largest contributors to climate change. The production of food, both plant- and animal-based, causes emissions of carbon dioxide, methane, and other greenhouse gases through multiple vectors which include deforestation and clearing of land for agriculture and grazing, the release of gases caused by the digestion of cows and sheep, the production and use of fertilizers and manure for growing crops, and the use of fossil fuels to run farm equipment or fishing boats (United Nations, 2024). Agricultural practices contribute to greenhouse gas production, with one of the largest contributors being livestock production. The widely accepted global greenhouse gas emissions estimates that 8 to 18% of global anthropogenic emissions come from the 17 billion domestic food-producing animals (Herrero et al., 2015). Livestock, particularly cattle, releases large amounts of methane gas that is a byproduct of digestion. This is particularly troubling because methane is a more effective greenhouse gas compared to carbon dioxide, but methane isn’t the only source of greenhouse gas emissions from the livestock industry. The main types of greenhouses gases from livestock production are methane production from enteric fermentation in cattle digestion and animal manure, CO2 from land use and its changes, and N2O from manure and slurry management (Herrero et al., 2015). Globally, livestock production uses around 3,900 million ha of land, which is around 80% of all agricultural land combined. The land quality and intensity of usage of livestock systems vary globally, but most of the land is being used by extensive, grazing-based ruminants like cattle and sheep (Herrero et al., 2015). The fact that humanity relies so much on livestock production in agriculture means that we are emitting large quantities of greenhouse gases. This is especially prevalent in the United States where so much of our food is livestock and meat that are funneled into industries such as fast food. A devastating consequence of both monoculture and livestock cultivation is the loss of natural land. Millions of hectares of land have been disturbed by increasing agricultural demands, transforming natural plains and forests into agricultural land which causes a 25% loss of carbon storage (Houghton, 2000) because agricultural land has less biomass to sequester atmospheric carbon. The net result is that agriculture not only increases greenhouse gas emissions but also transforms natural landscapes such as plains and forest into croplands that cannot efficiently act as carbon sinks.

In summary the current agricultural model in the United States causes detrimental environmental damage and is not sustainable. Our current system is monoculture based, which emphasizes exploiting environmental systems to generate the highest crop yields. This is achieved through the widespread use of synthetic agrochemicals such as fertilizers and pesticides, the use of machinery to increase crop cultivation efficiency, and the prioritization of high yield and valuable crops. These characteristics of monoculture allowed the human population to grow as much as it has, but it isn’t without its consequences. These consequences include loss of biodiversity, environmental degradation due to increasing pollutants from agrochemicals and equipment, and climate change. The production and overuse of agrochemicals results in the release of greenhouse gases into the atmosphere which only contributes to increasing the effects of climate change. These negative impacts of monoculture show us that our current system of agriculture isn’t sustainable, and for the betterment of humanity we must change our current agricultural practices.

Chapter 3: Sustainable alternatives

It has become clear that the current agricultural practices in the U.S. are unsustainable. The heavy reliance on artificial fertilizers and other agrochemicals damages the surrounding environment and significantly contributes to climate change (Gandara et al., 2024). Is there a way to make this industry more sustainable? While there are alternative models of agriculture that the U.S. could follow to reduce the environmental impact of agriculture, they are not widely practiced in the United States. This need for change must be balanced with the fact that the agriculture industry needs to be able to meet the food demands of the country, which leads us to a trying predicament. How can the US change its agricultural system to be more environmentally friendly when the strategies and tools we need to have high crop yields are responsible for degrading the environment? There are existing alternatives that have less negative environmental impact.

One alternative model that the U.S. could adopt is the pasture ley model which incorporates crop rotations that increase soil nutrient availability (Arrobas et al., 2016). Crop rotation, the practice of planting multiple crops on designated plots of land and rotating them, should be a component of a more sustainable agricultural system because it would maintain soil nutrient levels and would decrease reliance on synthetic fertilizers (Zou et al., 2024). Crop rotation is an ancient agricultural practice that has been widely practiced across the world since ancient Greece and the Roman Empire (Tariq, 2019). Crop rotation is a practice widely used in the United States, with around 82 percent of crops in the United States being grown in a crop rotation (Wallander, 2013). However, despite this widespread use of crop rotation, most farms implement simple crop rotations. In the United States the most common crop rotation practiced is a simple two-crop rotation of corn and soybeans (Tong, 2021). The simplicity of crop rotations becomes even more evident because only 3 to 7 percent of crop rotations implement cover crops which can diversify crop rotations (Wallander, 2013). Cover crops are when crops are planted not to be harvested but rather to cover the land and later be incorporated into the soil. Cover crops are essential to maintaining soil health because they protect unused fields from erosion while also incorporating new nutrients. Crop rotations should be designed to promote crop diversity with cover crops because having diverse and dynamic crop rotations promotes soil health and enhances nutrient availability for crops. By increasing the diversity of cultivated crops farmers will have higher yields all around. Diverse crop selection also decreases the amount of yield lost to disease and pests because it is harder for them to spread in a diverse population. But crop rotations should not only be limited to plants when livestock can be integrated into phase pastures by allowing them to graze in the resting plots. Livestock integration into crop rotation enhances soil health because it increases nitrogen availability in the soil from manure produced by grazing livestock (Arrobas et al., 2016).

Another key aspect of this model of agriculture is the integration of legumes into crop rotations. Pulse and pasture legumes are cultivated in agriculture because they enhance the overall productivity of the cropping system by adding nutrients to the soil. Legume species like soybeans and lentils symbiotically associate with nitrogen fixing bacteria, which allows them to convert atmospheric nitrogen to plant available forms like ammonium and therefore perform well even in low fertility soils (Arrobas et al., 2016). Supporting this symbiotic relationship with nitrogen fixing bacteria by rotating legumes with other crops would increase soil nutrients. This would allow for greater crop yields without the need for excessive amounts of synthetic fertilizers. Nitrogen-fixing bacteria will often make more nitrogen than the legumes need (Rao, 2000) and thus increase the usable amount of nitrogen in the soil for the next crop in rotation. If crops like corn with large nitrogen demand are rotated with legumes, then corn crops can use the nitrogen left by the legumes without compromising the integrity of the soil (Rao et al., 2000). Using this strategy of growing grain after legumes results in a higher grain yield than traditional monoculture (Rao et al., 2000). A comparative study between maize monoculture and pasture ley found that after five years of pasture and maize monoculture, the pasture ley plot presented significantly higher average values of nitrogen in the surface layer in comparison to those found in the maize monoculture (Arrobas et al., 2016). This study showed that the soil nutrient concentrations increased with the pasture ley model because it increased the amount of surface level nutrients including available carbon and nitrogen. This same study also found that yields of crops after pasture ley were higher than standard monoculture. Plant nitrogen concentrations were also significantly higher in maize plants grown in the pasture ley plots than in those cropped with maize monoculture (Arrobas et al., 2016). Therefore, rotation of high nitrogendemand crops with legumes results in higher crop yields due to more nitrogen being sequestered in the soil, and integrating legumes into crop rotations could be key to increasing crop yields while simultaneously using less artificial fertilizers.

Another change that the agriculture industry could make to become more sustainable is the integration of livestock into plant-based agriculture. Integrated crop/livestock agriculture is defined as the practice of managing crops and animals on a single farm. Research shows that integrated agriculture may enhance crop production and farm economy (Hilimire, 2011). The goal of these systems is to use the waste products from one to grow the other. An example of this is the use of manure produced by livestock to fertilize fields for crops. In the United States livestock integration is not widely practiced in any region, but the most common practices of livestock integration are sod-based crop rotations and livestock grazing on cover crops within cash crop rotations (Sulc et al., 2013). Sod-based crop rotations focus on the integration of perennial forages which establish strong root systems that allow for the tops of the plant to regrow. With careful management of grazing as to not disturb the root systems, livestock can feed on sod-based rotations for multiple years without needing to replant the crop. An explicit example of this in the United States would be planting alfalfa, a perennial plant, and having cattle graze on it. Both practices allow for the soil to maintain stable levels of essential nutrients and mitigate the negative environmental effects. This is accomplished by the crops themselves providing more nutrients to the soil and the leftover nutrients from livestock waste. Livestock can enrich soil quality when they are integrated with crop rotations, but there are multiple ways to integrate livestock into agriculture.

The integration of livestock and crops includes three levels of integration: fully separate, rotational, and fully integrated. Spatially separated integration separates the cultivation of livestock and crops into permanent pastures (Hilimire, 2011). This allows for easy gathering and application of both animal and crop by-products, such as manure or forage crops. The second method of integration is rotational in which livestock and crops occupy the same field but at different times (Hilimire, 2011). This system naturally incorporates the by-products of both livestock and crops with much less human intervention in comparison to spatial separation. Excrement is spread through the field via animal activity, and livestock would graze in fields not being used for crop cultivation. The final type of integration is fully combined in which livestock graze underneath or in between crops (Hilimire, 2011). This type of integration is commonly used in agriculture where the crops are not at risk of destruction due to livestock. As such, orchards and vineyards are the most viable model for this type of integration because the fruits are too far away for the livestock to eat, or the crop is unpalatable. This system can also be used for pre- and post-harvest. These methods of integration show that there are multiple ways to integrate livestock into agriculture to make it viable for farmers. Not all farmers have the same economic means, so this variety in methods of integration allows for more people to implement these practices. The implementation of these integration models will vary amongst farms based on specific environmental conditions and the available resources of the farm. Despite the variation, I would recommend the rotational model as a good entry model because it requires less specialized land and will allow for the rotation of nutrients

One benefit of integrating livestock into plant-based agriculture is that livestock increases the nutrients within the soil and promotes healthy crop growth. Incorporating a livestock component increases farms’ nutrient cycling ability and allows them to take advantage of the integration of pasture phases in the crop rotations (Arrobas et al., 2018). Nutrient addition from nitrogen-rich animal manure happens with all three levels of integration. In the spatially separated integration, farmers get the least amount of benefit because of how labor intensive the application of manure is. Due to livestock and crops being completely separated in spatial integration, farmers must collect and move all manure produced by the livestock to the active agricultural plots to obtain nutrient enhancing effects. In comparison, rotational and fully combined integration requires a lot less effort because there is no intensive labor process to gather and apply manure. In both integration systems the livestock is already living on the land that needs to have manure applied to it. The natural grazing behavior of the animals ensures an even distribution of manure across the field, thus adding essential nitrogen nutrients that will increase future crop yields. In order to facilitate this grazing behavior cover crops must be planted in empty plots. Cover crops also provide essential nutrients like nitrogen that enhance soil health (Sulc et al., 2013). While farmers would have to account for the extra expenses of planting cover crops, the environmental benefits and the increase in crop productivity are a greater benefit.

Another part of the agriculture industry that needs to become more sustainable is the livestock industry itself. Interestingly, livestock both contributes to and experience the negative effects of climate change. Global warming puts livestock under significant stress through increases in ambient temperature and a decrease in water availability, which will result in livestock experiencing more heat stress and becoming more susceptible to diseases (Scholtz et al., 2014). This increase in heat stress and disease will make it harder for farmers to cultivate livestock in large numbers. This reduction in physical fitness combined with a reduction of water and feed supplies lowers livestock productivity. This means that the livestock industry will face lower yields due to the additional stress livestock experience with climate change. So, to fight against climate change and improve livestock fitness the livestock industry must become more sustainable.

One of the key aspects of making the livestock industry more sustainable is to improve efficiency of land use. An effective way to reduce the carbon and water footprint from livestock production is to increase the efficiency of livestock production (Scholtz et al., 2014). This would allow the livestock industry to take concrete steps towards reducing its negative environmental impacts while still maintaining production. One such method of increasing the efficiency of livestock is to plant cover crops for livestock to feed on. The cover crops would provide both nutrients for the soil and food for livestock to graze on rather than relying on supplying animal feed developed in monoculture (Sulc et al., 2013). This means that the total land used for livestock production would be reduced because farmers would have to dedicate less land to generating livestock feed. While removing the livestock industry entirely is a topic of discussion among climate activists, it isn’t a realistic strategy. With rapid population growth and increasing development of foreign nations, the demand for meat has also increased (Sabate, BadillaBriones, & Sabaté, 2019). The livestock industry plays a crucial role both in the U.S. and globally and completely removing it will cause millions of people to lose their livelihood. Instead, we should focus on ways to reduce the size of the livestock industry to mitigate climate change, while improving the efficiency of land use in this industry. Some ways to improve efficiency in this industry are through breeding, feeding management and alternative production systems (Scholtz et al., 2014). Crossbreeding of livestock strains could select traits that allow livestock to be more resistant to environmental changes. Alternate integrative livestock models like integrating cover crops into livestock phases of crop rotation would reduce the amount of land that is being used to cultivate livestock. This land use reduction would lower the negative effects of climate change by reducing the amount of land used in livestock cultivation and the quantity of synthetic fertilizers used in crop cultivation (Sulc et al., 2013).

With all these alternative models in new technologies one would think that the U.S. agriculture industry would be taking large steps towards making agriculture sustainable. Other countries in Europe have already started implementing sustainable practices into agriculture to fight climate change. One such example is the Netherlands which has implemented Integrated Arable Farming Systems (De Buck et al., 2008). These are agricultural models that use principles of livestock integration and diverse crop selection to cultivate diverse food selections sustainably. However, despite new research and innovation taking place across the world, the U.S. continues to practice damaging and unsustainable agriculture because the U.S. government reinforces current agricultural norms through government lobbying. The slow expansion of sustainable farming systems in the United States is as much a policy and market problem as a science and technology problem. To hasten the integration of sustainable agriculture in the U.S., changes must be made to create incentives for appropriate markets. Reform of U.S. farm-related policies, and reorientation of publicly funded agricultural science are some of the first steps needed to create this change (Regonald et al., 2011). The politics and economics surrounding the agricultural industry are complex and convoluted, but they are one of the largest factors limiting the integration of sustainable practices into agriculture. The most prominent actor against sustainable agriculture is large agricultural companies that lobby against changing policies. Current federal farming policies are heavily influenced by lobbyists from large agricultural conglomerates and consolidated farming industries. These stakeholders do not incentivize such “climate-smart” agriculture practices (Thurman, 2022). These lobbyists donate to politicians and support them to consolidate their political influence, and in the process reinforce status quo agriculture policies and the continued favor of large-scale monoculture.

One attainable change to agriculture policy is to shift the requirements for government subsidies to grants so that distribution is more equitable. A more workable policy would be to offer a predetermined share of subsidy incentives to all farmers based on their farming practices, irrespective of crops cultivated or farm size. Doing so would incentivize sustainable practices such as integration of livestock with crops and the implementation of diverse crop rotations. This would create a more equitable system than the current subsidy framework that excludes 60% of American farmers from any subsidies whatsoever (Eubanks II, 2013). Farms that implement more sustainable practices often never see government subsidies, because the food produced using sustainable practices isn’t covered by current federal policies. These farmers are those who grow most of the nation's fruits, vegetables, and nuts, which are called "specialty crops" in the farm bill, but are critical for good health (Eubanks II, 2013). Farmers who end up cultivating crops that fill critical dietary needs, such as fruits and vegetables, are not getting the support they need.

This brings me to the heart of the issue with implementing sustainable agriculture in the United States: with the structural challenges current agricultural system is set up it is extremely difficult to see widespread change. There are many stakeholders in this complex issue that make it extremely difficult to make changes. Large scale agricultural companies, such as Dole, spend significant capital in donations to lobby policy makers. This lobbying means that current agricultural policy will see minimum changes, and that funding will continue to be allocated to support large scale agricultural companies instead of sustainable agriculture. To answer this question, I would say that there is hope for more sustainable agriculture in the United States, and that the federal government needs to take accountability for implementing these changes. The government needs to shift away from lobbyists and instead funnel government funding towards sustainable agriculture like organic produce and crop integration. While crop rotation is widely practiced in the United States, only 3 to 7 percent of these crop rotations implement cover crops. By providing more funding for diverse crop rotations, more farmers will implement these practices. Individuals can help create this change by exercising their right to vote and supporting local farmers. Electing representatives that are willing to learn about and work on improving sustainability are the first steps towards a more sustainable United States. If the government can properly incentivize sustainable agriculture, it will allow farmers to implement these practices since they can afford it. Outside of voting one of the most important tasks individuals can undertake is to shop local. By shopping from local farmers market and buying organic produce from supermarkets your money goes towards sustainable agriculture rather than to big corporate agriculture. Overall, I argue that it will take a significant amount of effort to break out of our current system, but if the government properly incentivizes sustainable agriculture and shop organic to support farmers by buying organic, then the United States can take the steps necessary to make agriculture more sustainable.

Conclusion

Through this investigation into sustainability one point has become abundantly clear: agriculture and the environment are dependent on each other. Agricultural productivity is controlled by pre-existing environmental conditions, and areas with the greatest abundance of nutrients become the centers for agriculture and civilizations. This trend was observed in both Mesopotamia and China, ancient civilizations with access to large bodies of water that allowed for large quantities of crops to be cultivated. In ancient Mesopotamia, the Tigris and Euphrates rivers were vast water sources that resourced irrigation systems to cultivate large areas of land. In ancient China, the Yellow River and Yangtze River provinces are the two centers for agricultural development. In both regions, access to large rivers for irrigation and particularly nutrient-dense soil led agricultural development in these regions to flourish. These two ancient examples and differences in agriculture within British American colonies show how areas with abundant natural resources became the centers of agricultural development.

Despite the importance of pre-existing natural conditions in agricultural development, humans were able to expand agricultural lands and occupy lands that were previously thought to be unproductive for agriculture. Humans can use technology and agricultural innovations to overcome limiting environmental factors. This phenomenon has a long historical precedent and has been observed in many ancient human civilizations, with one example occurring in the Southern provinces of China. The southern provinces of China were relatively unremarkable with a sparser population and low levels of technological development in comparison to the Yellow River and Yangtze River provinces. However, through the technological innovation of rice paddy irrigation systems, the southern provinces of China were able to increase food production which allowed for a greater number of settlements to be constructed and thus allowed for the region’s population to grow. Through technological innovation farmers can overcome limiting environmental factors to increase crop production, which in turn leads to societal growth and drives the population to increase. This trend continues into the modern era, where the Green Revolution and the creation of agrochemicals allowed the Earth to support many more humans globally. Agrochemicals allow modern agriculture to add essential nutrients for growth like nitrogen to any soil. This is an amazingly transformative force in agriculture because agrochemicals allow farmers to expand and cultivate lands that were previously unused. Agrochemicals are the technological innovation created to overcome barren land with low soil nutrients.

The monoculture system employed within the United States does an excellent job producing a high volume of food stuff. Using specialized crops strains, agrochemicals, and machinery, the monoculture system can produce the largest yield possible. But this model is not sustainable, as it focuses on generating the largest yield possible with little to no regard for the negative environmental effects it has. Monoculture is very damaging to the natural environment because the overapplication of agrochemicals causes excessive release of greenhouse gases into the atmosphere and excess agrochemical leaching from farms into the surrounding environment, lowering biodiversity in terrestrial and aquatic ecosystems alike. Furthermore, processes essential to monoculture including operating machinery to harvest crops or the creation of agrochemicals require the use of fossil fuels which result in large atmospheric emissions of greenhouse gas that exacerbate climate change. Agriculture, therefore, must become more sustainable to mitigate these negative environmental effects.

This is why I believe that there must be a new wave of innovation within agriculture, a third Green Revolution that focuses on making agriculture sustainable. Currently there are agricultural practices and technologies available that lower the environmental impact of agriculture. Crop rotations and the integration of livestock with crop cultivation are two excellent strategies that can be implemented now to reduce the environmental impact of agriculture. Both strategies reduce the environmental impact by limiting the number of agrochemicals farmers need to apply. Crop rotation promotes soil health with a balance of nutrients because the crops naturally restore nutrients to the soil, which means that farmers who implement this practice can use less agrochemicals. Integration of livestock into crops enhances the nitrogen content of the soil due to manure from the livestock enriching the nitrogen content of the soil. This results in farmers having to use lower levels of synthetic fertilizers.

Strategies such as these are good for making agriculture more sustainable, but not many farmers can employ sustainable practices because they cannot afford to. In the United States most federal aid goes towards big monoculture companies, making it significantly harder for farmers to try sustainable practices on their farm. Combined with lobbying from these agricultural companies, it seems impossible for sustainability to become widespread in agriculture. But there is still hope. If farming policy changes so that more money is allocated for sustainable agriculture, it would make it more affordable for farmers to use these technologies and cheaper for consumers to buy these goods. Some actions that people can take individually to support sustainable farming are to source your food locally when you can and to buy organic products from the store. Farmers are required to follow agricultural practices that ensure the production process is more sustainable than their monoculture counterparts.

#### Each planetary boundary causes extinction---specifically, the nitrogen cycle.

Gilles Billen 24, Emeritus CNRS Research Director, territorial biogeochemistry, Sorbonne University, "How industrial agriculture is disturbing the nitrogen cycle and undermining conditions for life on Earth," The Conversation, 01/03/2024, https://theconversation.com/how-industrial-agriculture-is-disturbing-the-nitrogen-cycle-and-undermining-conditions-for-life-on-earth-220478

Six of our nine planetary boundaries have now been crossed – and industrial agriculture are the main culprit. That is what a team of scientists under Johan Rockström reported in an article published in September..

First, a reminder: planetary boundaries are thresholds of disturbance beyond which our Earth’s system are put on an uncontrollable and irreversible path that undermines the very conditions for life. This notion of overstepping boundaries is clear in regard to the best-known limit of them all: that of climate change. In order to cap global warming at 1.5°C above pre-industrial levels, and prevent it from escalating beyond bearable conditions (even if this is not enough to stop climate disruption already underway), we need to keep the proportion of atmospheric CO₂ below a certain limit. And to achieve this, we need to reach carbon neutrality, quickly.

Regarding the climate, it is easy to see how such a global limit is relevant: the carbon cycle is open to the whole planet and CO₂ emitted (or captured) anywhere on Earth immediately affects the world’s atmosphere in its entirety. Yet in the case of the planetary boundary for nitrogen, exceeding the threshold is different, as it is the industrialisation of agriculture that is largely, and more complexly, responsible for breaking the limit.

But how can agriculture affect the nitrogen cycle? How has it managed to reach a breaking point? To feed the world, isn’t intensive agriculture best? Let’s take stock of the situation.

The natural nitrogen cycle

First, we need to understand the natural cycle of carbon and nitrogen – two of the main elements that form living matter. We can observe this cycle in forests, for example. To function, forests rely on a balance between plants growth – a process that turns mineral (inorganic) forms of carbon and nitrogen into biomass (organic) – and animals, fungi and micro-organisms decomposing this biomass, a process that remineralises it.

But whereas the inorganic form of carbon (CO₂) is present in the atmosphere, distributed evenly worldwide and absorbed by plants via their leaves, nitrogen is remineralised in the soil and absorbed by plant roots. So, the boundaries of the nitrogen cycle have to remain local: any loss of nitrogen brings about a risk of soil depletion, which jeopardises continued plant growth.

Yet inorganic nitrogen in soil is remarkably mobile. It exists in several forms, including ammonia (NH₃, NH₄+), which is very volatile, nitrous oxide (N₂O), which is gaseous, and nitrate (NO₃-), which is highly soluble. The amount of nitrogen that is lost in the atmosphere and in groundwater is therefore considerable, and this loss makes nitrogen the main limiting factor in plant growth.

However, nitrogen is widely present in the Earth’s atmosphere, making up 78% of it. But it exists in the atmosphere in its molecular form as N₂ – an inert gas that most organisms are unable to use. Only plants in one particular family – legumes (peas, lentils, beans; clover, alfalfa; and some trees, such as acacia) – are able to draw on this reserve of gaseous nitrogen. They do so through a symbiotic association with bacteria that have enzymes needed to convert molecular nitrogen into proteins. It is this symbiotic fixation that offsets the natural environmental loss of nitrogen and ensures that terrestrial ecosystems function perennially.

Farming and fertilisation

In agricultural systems, the nitrogen cycle is structurally open. Each time plants are harvested, the nitrogen contained in them is carried far away from the plot of soil where it came from. So, to avoid soil depletion, nitrogen taken away from the soil – whether through harvesting or environmental loss – has to be put back in the soil in one way or another. That is the purpose of fertilisation.

There are many methods of fertilisation. Excrement from animals and humans that have eaten plants can be spread as fertiliser. That is the most natural process for keeping the nitrogen cycle closed. However, it can be hard to carry out properly if the place where the plants are eaten is a long way from the place where they are cultivated. But the excrement of livestock grazing on semi-natural pastures can be spread on neighbouring arable land. This process transfers the fertility of these pastures to the neighbouring arable land.

Indeed, this method was the basis of traditional systems of polyculture and livestock farming. Another way of providing cereals with nitrogen is crop rotation: growing cereals in alternation with leguminous plants on the same plot. With this method, nitrogen is fixed by the leguminous plants that grew on the plot before the cereals did.

Add to that mix industrial fertilisers, which have been around for just over a century. Shortly before the First World War, the German chemists Fritz Haber and Carl Bosch developed a process for producing ammonia (NH₃) and, later, nitric acid by using high temperatures and pressures to force a reaction between nitrogen from the air and hydrogen (from coal back then, but today from natural gas).

This process was first used to make explosives, but it later served to mass-produce synthetic nitrogenous fertilisers. These new fertilisers increasingly became the go-to option to fertilise farmland soil. They quickly made traditional polyculture and livestock farming obsolete and paved the way to intensified and specialised agriculture, which was henceforth coupled with the heavy chemical industry.

Some writers consider the Haber–Bosch process to be “the most important industrial process” of modern history, foreshadowing among other inventions the aeroplane, nuclear energy or the television. In 1925, the biologist Alfred Lotka marvelled

This extraordinary development the Haber–Bosch process is something more than a fundamental new departure in industry. It represents nothing less than the ushering in of a new ethnological era in the history of the human race, a new cosmic epoch.’

And that is what this issue is about: this new epoch that we call the Anthropocene. Today, on a global scale, the quantity of reactive nitrogen that the fertiliser industry puts into the biosphere each year exceeds the amount provided by all natural processes of biological fixation. On a global scale, the speed at which nitrogen circulates has therefore increased more than twofold..

Environmental nitrogen loss

In this accelerated flow of nitrogen, what causes trouble is the environmental nitrogen loss that results from it. Indeed, the more nitrogenous fertilisers are used to increase crop yields, the less the added nitrogen is effective and the greater the losses through leaching and volatilisation. What we call the nitrogen surplus is the excess of nitrogen put into the soil in relation to the quantity actually taken away through harvesting.

It is this surplus that contaminates groundwater, making it undrinkable, and river water, which leads to the eutrophication of coastal waters – the cause of green tides, toxic algal blooms and deep-sea anoxia.. And it is this surplus that releases ammonia into the atmosphere, which creates aerosols with serious effects on human health..

That is why the team working under Rockström evaluated the agricultural nitrogen surplus when defining the planetary boundaries beyond which the conditions for human life on Earth would no longer be guaranteed. The upper limit of this surplus, which is determined to protect water and air locally, varies greatly between world regions, but on a global scale it is estimated to be 60 million tonnes of nitrogen (60 TgN/year), in contrast to today’s nitrogen surplus of around 130 TgN/year.

This huge gap between the threshold not to be overstepped and the actual level reached today justifies the goal that the European Commission and the United Nations’ Biodiversity Conference recently set itself to halve nitrogen waste by 2030.

Yet it is not by simply adjusting practices that nitrogen waste from agriculture will be halved so that the planetary boundaries are respected. Industrial producers of fertilisers promote the progress offered by precision agriculture, nitrification inhibitors applied to soil, varietal improvement of crops, and so forth.

These new methods that promise progress might open up new lucrative markets for the agricultural supplies industry, but everything else points to them bringing only a negligeable drop in nitrogen waste. Indeed, the most effective way to boost efficiency and reduce loss is to scale down agricultural production itself!

Feeding the world without ruining it

But can we reasonably scale down intensive farming without jeopardising the food security of a world that will have 10 billion mouths to feed by 2050? Many recent studies claim that we can. Yet we can only do so if three major structural changes are made to the entire agrifood system at the same time as intensive agriculture is toned down.

#### Intravarietal monocultures cause extinction.

Patrick Mulvany 21, Centre for Agroecology, Water and Resilience, Coventry University, “14 - Sustaining Agricultural Biodiversity and Heterogeneous Seeds,” Rethinking Food and Agriculture, edited by Amir Kassam and Laila Kassam, Woodhead Publishing, 01/01/2021, pp. 285–321 ScienceDirect, doi:10.1016/B978-0-12-816410-5.00014-1

As compared with wider biodiversity “the special nature of agricultural biodiversity, its distinctive features, and problems needing distinctive solutions” was recognized by the Convention on Biological Diversity (CBD) in its early years (CBD, 1994), confirming the need for globally agreed management and governance measures that are distinct from those governing the preservation of wider biodiversity through, for example, Protected Areas governance measures. These measures recognize that, for example: people have a key role in sustaining and dynamically managing agricultural biodiversity; many components of agricultural biodiversity, such as the diversity of the seeds of food crops, would not exist without this dynamic management and associated indigenous and local knowledge and culture; intraspecific diversity and intravarietal diversity within productive ecosystems are at least as important as diversity between species; access to, and control over, components of agricultural biodiversity can be restricted by legal and technological means thereby potentially limiting its availability; and that many food production systems are based on species introduced from other communities, countries, and continents, creating great interdependence on agricultural biodiversity across the world.

Small-scale food providers’ perspectives on the importance of agricultural biodiversity

Biodiversity has as a fundamental base the recognition of human diversity, the acceptance that we are different and that every people and each individual has the freedom to think and to be. Seen in this way, biodiversity is not only flora, fauna, earth, water and ecosystems; it is also cultures, systems of production, human and economic relations, forms of government; in essence it is freedom (Via Campesina, 2000).

● Agricultural biodiversity is enhanced by and supports agroecological production: it is an essential pillar of peasant strategies for survival and autonomy through reducing costs and risks. Peasant agroecological production systems have cultivated, sustained, and developed millions of heterogeneous varieties of crops and trees, breeds of livestock, and diverse aquatic organisms over millennia, and throughout the world. These nurture healthy populations of pollinators, pest predators, soil, and aquatic organisms above and below ground and in waters.

● Agricultural biodiversity is intertwined with our knowledge: it is more than the diversity of genetic resources, species, and ecosystems. It essentially includes the knowledge that led to its development and for its use. This knowledge is embedded in a dynamic web of relations between human beings and nature, continuously responding to new problems and finding new solutions.

● It makes the environment more resilient: environments rich in agricultural biodiversity are ecologically resilient to climate change and other threats, and also deliver other benefits to the environment and people, such as improved soil water retention, less soil erosion, increased soil biodiversity, improved pollination, as well as clean air and water.

● It improves the health of people and the planet: agricultural biodiversity is essential to human survival and health; when this biodiversity is diminished, disequilibrium results, which threatens health, both of humans and of nature.

● It is the product of their knowledge and collective rights: the successful enhancement of agricultural biodiversity—through exchanges within and between small-scale producers, countries, and continents—depends on peasants’ knowledge and collective rights of access to and control over territories, waters, seeds, and biodiversity.

● Its enhancement requires the freedom for peasants to choose the social system, the agrarian system, and culture that value it in a holistic sense, in the face of economic “values” imposed by a “free” market that destroys peasants’ seeds, biodiversity, and associated cultural freedoms.

Adapted from IPC (2016).

14.3 Threats to agricultural biodiversity

The negative impact on agricultural biodiversity from industrial agriculture, intensive livestock production, and large-scale mechanized fisheries is summarized in many international assessments that have been completed this century, from the International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD) to FAO’s report on the State of the World’s Biodiversity for Food and Agriculture (FAO, 2019; IAASTD, 2009). Through land use change, destructive and unsustainable management of ecosystems and “downstream” pollution of more biodiverse production systems, industrial monocultures are the main cause of the loss of biodiversity. Industrial production and the value chains it supplies with their associated transport, processing, storage, and retailing systems are also principal drivers of climate change, through associated greenhouse gas emissions, causing further stresses for biodiversity (GRAIN & La Via Campesina, 2014).

The loss of biodiversity in agroecosystems brings devastating consequences … simplified, human constructed agroecosystems may be unable to maintain their structure … [with] the accelerated loss of resilience and diversity and the erosion, salinization or decline in the fertility of soils.

Egziabher (2002)

The impact of these industrial production systems on agricultural biodiversity is even more marked. Over the past 70years, in the wake of 20th century global conflicts and subsequent instability in food supplies, international efforts to increase production of staple grains and commodities have been further intensified. These efforts include the consolidation, intensification, and simplification of peasant systems (Green Revolution technologies) with the expansion of genetically uniform monocultures displacing production using biodiverse peasant varieties. In addition, with the global spread of the industrialization of agriculture and livestock production, including largescale land use changes from forests to plantations and cropping, and the expansion of industrial livestock production and large-scale fisheries, agricultural biodiversity has been further eroded.

Causes of loss of agricultural biodiversity

The social movements of smaller-scale food providers have summarized their views on the principal causes of the loss of agricultural biodiversity:

● The industrial model of production and consumption is rapidly eroding rural societies that manage agricultural biodiversity.

● The industrial model of production also displaces peasant varieties and breeds through using genetically uniform, and, increasingly, genetically modified, monocultures of crops, livestock, and fish, while locking up diversity in gene banks.

● Land grabs and ocean/water grabs extend the area under this model of production.

● Intensive use of pesticides, herbicides, and chemical fertilizers further reduces agricultural biodiversity and ecosystem functions.

● Climate change, exacerbated by this model, is putting new pressures on the local diversity of crops and livestock as weather patterns change, and new pests and diseases proliferate. Consequent disaster relief efforts distributing inappropriate, often industrial, seeds and livestock breeds undermine local agricultural biodiversity.

● Industrial research systems for this model devalue and erode peasant and indigenous knowledge, local research capacities, and the multitude of local innovation systems that foster agricultural biodiversity.

● Monopolies, favored by this model, control industrial seed, agrochemical, and industrial commodity markets and value chains, and this jeopardizes freedom for peasants to control, access, and use agricultural biodiversity.

● Intellectual property rights (IPRs) (sometimes dubbed “industrial” property rights by peasant organizations because they defend the interests of industry) and other laws that protect seed monopolies stimulate the widespread use of industrial varieties and can also criminalize peasant producers who develop, use, share, exchange, and sell their heterogeneous seeds.

Adapted from IPC (2016).

The industrial model of production favors the use of crop varieties, livestock, and aquatic breeds that respond to high applications of agrochemicals and intensive feeds, and the simplification of ecosystems. Its impacts in rural territories across the world include not only the rapid spread of monocultures but also massive increases in the use of associated pesticides and herbicides, resource consolidation, and the exodus of producers. The industrial model of production also produces excessive waste; it is built on an economy of surplus production of commodities rather than on the basis of ecological sustainability and realizing food sovereignty and the Right to Food. This model underlies the dysfunctionality of our food system (Mulvany & Ensor, 2011; van der Ploeg, 2009). An alternative view, as Eric Holt-Giménez has often pointed out, is that the system is not dysfunctional, but rather functioning as intended; it was never meant to provide good food for all, or preserve the environment, but to serve vested interests (Holt-Giménez, 2017).

14.4 Few crops “Feed the World”?

While industrial production systems per se undermine agricultural biodiversity for all the reasons cited previously, and more, a further determining factor is that, for complex reasons, probably related to power and control, human civilizations have selected relatively few crops for most of their food. By focusing on these few species, it can skew the discourse on sustaining agricultural biodiversity to the exclusion of concern about the diversity of the very many other species that are important for a sustainable food system.

Estimates of the numbers of “how many crops feed the world” often build on the work of the Prescott-Allens (Prescott‐Allen & Prescott‐Allen, 1990). Their conclusion was that most food in the global food system comes from 82 species commodities as they describe them (i.e., species as well as genera, such as the cabbage family Brassicaceae) consisting in total of 103 species. These, they calculate, contribute 90% of national per capita supplies of food plants. Subsequently, Colin Khoury and colleagues concluded, based on the analysis of FAO data in 2014, that the number is slightly fewer, i.e., 94 species (Khoury et al., 2014). In answer to his own question, “So how many crops feed the world anyway?,” Guarino (2014), in the Agricultural Biodiversity Weblog, summarizes the state of knowledge and more or less concurs with the estimate of Khoury but adds Quinoa—increasing the number to 95 species— and reflects that precision about the exact numbers is not particularly important. The number is indicative of the limited number of species that dominate the global (especially industrial) food system.

[FIGURE 14.1 OMITTED]

Fig. 14.1 shows the number of crops used directly for food, in part or wholly, which dominate the industrial food system. It is based on an interpretation of the data recorded by FAO for 2018.

There seems to be general consensus that only three species—maize/corn, rice, and wheat— provide about half the world’s plant-derived calories (Tutwiler, Bailey, Attwood, Remans, & Ramirez, 2017), and, with potatoes, the proportion increases to about 60% of the formally recorded food system. The choice of the next eight species that, with maize/corn, rice, wheat, and potatoes, make up 75% of the industrial food supply, varies, depending on the author. They may include plantains and bananas, sweet potatoes, yams, cassava, and other roots, cereals such as barley, oats, rye/ triticale, sorghum/millets, chickpeas, and other pulses.

The species in the additional 83 crops that provide 90% of food include some that might be suitable substitutes in the foregoing list of eight species, e.g., several vegetables and fruits that have many varieties that are important locally, and a few of these varieties are also globally dominant in the industrial food system such as tomatoes, mangoes, and apples. Also, the list includes many vegetable species, such as those in the Brassica (cabbage family) and Allium (onion/garlic family) genera, common fruits, and many legumes and pulses. In addition to these 95 species there are some 7000 species known to be used by people for their food. The prevalence and importance of these is probably underreported.

What’s deliberately missing in this figure are industrial commodity crops, such as oil palm and other oil crops, soya, sugar cane, and sugar beet, which are traded as comestible commodities mainly for food processing and livestock feed, although on a smaller scale they may be used directly in local food webs.

Historically, human civilizations have selected relatively few species for their main foods. It is interesting to note that the four crops (maize/corn, rice, wheat, and potatoes), which make up 60% of the industrial food system, originated in regions that gave rise to significant empires; the Olmec, Aztecs, and Mayans developed their empires in MesoAmerica (today’s Mexico and Central America), the region where maize/corn was selectively developed from the grass Teosinte; rice developed in SE Asia where dynasties ruled for thousands of years; the Babylonian empires of the “fertile crescent” in West Asia arose in the region that developed wheat and other cereals; and in the Andean region, home to the Inca empire, potatoes were selected as an important food crop from the many roots and tubers that developed in the heterogeneous ecosystems on the slopes of the Andes.

The most important aspect of the quantification of the number of food crops that “feed the world” to this discussion about agricultural biodiversity is the recognition that, in reality, humans regularly grow and harvest food from more than 7000 species, and that there are up to another 70,000 species known to have edible parts (Tutwiler et al., 2017).

It is therefore plausible to suggest that there is underreporting of the wider number of species known to be used for food by people across the world. The few dominant species in the industrial food system, whose seed is increasingly controlled by a few corporations and whose production, trade, processing, and retail are captured in official records, bias attention in official statistics to these crops and, hence, in a selfreinforcing process also create a bias in food system presentation and planning.

Though a limited number of species are used in the industrial food system, the security of the world’s food supplies was attained through the use of a multiplicity of crop varieties and livestock breeds. Large areas of single species can be relatively resilient and maintain productivity if there were significant varietal diversity within the production system. Millions of diverse varieties of the commonest crops have been developed by farmers over millennia as they selected seeds for various traits over many generations and when they adapted crops to new environments. For example, more than 100,000 varieties of rice are known to have been developed in India. In the in vitro collections of the Peru-headquartered International Potato Centre there are more than 4000 varieties of potatoes and in the Global Seed Vault in Svalbard, a million accessions of diverse seed varieties are stored (Asdal & Guarino, 2018). While having the backup of diversity ex situ in gene banks provides some insurance, it is the in situ intraspecific and intravarietal diversity on-farm within a field that allows crops to evolve (Mulvany, 2017). This can compensate somewhat for limited species diversity in production systems. Tolerance of the different varieties of a single crop species within a field to varying weather patterns, rain/drought, heat/frost, changing soil conditions, diseases, insect attacks, and so on, can produce compensatory growth by one variety in the event that another variety suffers. Such has been the experience of peasant farmers in their biodiverse plots of, for example, potatoes. In Peru, peasant farmers in the Andes grow potato mixtures of up to 50 varieties in a “Challo” that, overall, can resist variable weather conditions and always provide consistent production from season to season.

Now, it is this biodiversity—the number of varieties of each species in current production systems—that is fast disappearing. Assessments conclude that for some crops, more than 90% of varieties are no longer being grown regularly on-farm and the number of livestock breeds is also diminishing (FAO, 1997a, 2007). The single greatest cause of the loss of varietal diversity is the result of their substitution, on a very large scale, by relatively few industrial varieties (FAO, 1997a).

This rapid erosion of the intraspecific variety within each species, i.e., the small number of varieties that dominate production, is of equal if not greater concern than the limited number of species grown. Genetically uniform monocultures of single varieties are easily susceptible to the effects of climate stresses and pests and diseases. Were this erosion of agricultural biodiversity to continue and production of the few industrial crops that dominate the industrial food system to become dependent on a limited number of genetically uniform varieties, the results could mirror, on a global scale, the impacts of the Great Irish Famine of the 1840s. This was caused, in part, because of failure of the staple potato crop; only two varieties of potato were being planted in the whole country at that time. They turned out to be susceptible to late blight and widespread crop failure resulted.

#### Restoring control to small farmers drives locally regenerative agriculture, which prevents extinction.

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Second, neoliberal policies have transformed agricultural markets. Over the past few decades, farmers have been increasingly shut out from the revenues accruing from their production. The means by which this exclusion has been achieved, however, are varied and complex.

Obviously, large corporations have the power to dictate market prices, to the detriment of millions of tiny producers. In that sense, open markets seem to militate against farmers. But the whole story is more nuanced. Developing-world farmers of cocoa, sugar cane or cotton rarely get market prices for their product. Standing between them and those prices, often, are the very same state institutions that were set up in the 20th century to protect farmer income. These marketing boards, and their fixed prices, have since drifted to an almost opposite function.

In 1947, for instance, Ghana set up market monopolies to ensure fair prices were paid to cocoa farmers. Now, those institutions interpret the ‘national interest’ in the opposite way. They act to keep prices low, and so to generate a subsidy, not only for the state, but also for exporters, processors and chocolate consumers. In 2023-24, international cocoa prices soared as high as $12,000 per tonne, but farmer income was capped at the government price, which oscillated between $1,800 and $3,000 per tonne. The interactions between international confectionary giants and West African government agencies are complex, but the results are not. In the 1970s, cocoa farmers earned up to 50 per cent of the value of finished chocolate; this fell to 16 per cent in the 1980s, and is probably now around 6 per cent. While the value of the chocolate industry has surpassed $100 billion, some cocoa farmers in those countries earn less than $300 per year. Ghana and Côte d’Ivoire, whose cocoa industries once provided jobs to migrants from all over West Africa, are now significant sources of migration to Europe.

Much of the world’s peasantry is now victimised both by free markets and by state-controlled socialist hangovers. Peasant politics is more complex, therefore, than is usually imagined. Many peasants follow the Left-wing movement La Via Campesina, which seeks to restore traditional peasant systems, and so to oppose genetically modified seeds and the corporate takeover of agriculture. But there are equally committed supporters of an almost opposite position. In places where old socialist protections have turned into instruments of price suppression, many farmers dream of free markets. As one agrarian campaigner told me in India: ‘We simply want to sell our crops at market prices. By protecting us, the government has made us destitute. We say: “Remove your protections, and let us deal with the consequences.”’

The third target of neoliberal reform of the countryside is peasant land. Contrary to conventional – urban – wisdom, most peasants wish to keep their land. I recently asked an Indian cotton farmer why he continued his back-breaking labour, when he hardly covered the cost of cultivation, and he had to work other jobs to fund his loss-making farm. Why did he not simply sell his land and focus on those more lucrative activities? ‘The land is our mother,’ he replied. ‘Do you sell your mother?’ His sentiment is shared by many peasants, for whom land represents not only economic security but also heritage, ancestors and the generations to come.

In many countries, however, selling agricultural land is not just undesirable, it is also difficult. The pro-peasant policies adopted by Egypt, India, Mexico and so many other countries in the 1950s and ’60s – which illegalised large landholdings, and prevented farmland from being acquired for other uses – now ensure that rural land markets remain weak, and prices low. Selling land may not even provide farmers with enough capital to start a new life elsewhere. Very often, therefore, they carry on farming. Even if their plot has shrunk, after generations of inheritance, below the threshold of viability; even if it has become degraded by a perennial lack of investment; even if revenues turn negative – they continue to cultivate it, rather than allow it to return to wilderness. The farm is not an income source, therefore: it provides merely stability, a family base, a sense of home. Around it, peasants create hypermodern economies: they do shifts in factories to subsidise cultivation, they send family members to do construction work abroad, they run local transport and services. Much peasant production is funded today from such other sources, and run like a loss-making public service. The brightly painted new façades in Cambodian villages are paid for, not with non-existent rice profits, but with remittances from family members working in South Korean factories.

When agricultural land is diverted to other uses, the process is often violent. In Brazil, Cambodia, Ghana, India, the Philippines and many other countries, farmers have been forcibly expropriated so their lands may be repurposed for plantations, mines and tourism projects. Often, these evictions are enforced by state agencies; in Ethiopia, Honduras and elsewhere, police forces have imprisoned or even shot farmers for protesting. But large areas of the global countryside are also becoming criminalised, and farmers find themselves also in competition with violent non-state forces. Peasant farmers are the primary victims, for instance, of illegal gold miners in Peru and Colombia, of timber and mining hustlers in Myanmar, of Russian-linked paramilitary groups occupying mineral deposits in Mali and the Central African Republic. The mines which so often emerge from such turbulence pollute the remaining farmland with cyanide and other chemicals, further destroying the peasant economy.

Two billion people cannot be relocated to cities. Yes, China’s rural population has fallen from 80 per cent in 1980 to 35 per cent – but China is unique. Even in neighbouring India, the rural population remains at 65 per cent, or 900 million people. The entire world’s manufacturing, construction and mining currently employ only 800 million people: clearly, the global peasantry cannot be absorbed into industry. We need to realise that, in the absence of exceptional levels of industrialisation, nothing can sustain large populations so well as the land. We need to stop seeing urbanisation as the main index of developmental progress, and realise that it is, in many cases, the sign of a major disaster: the destruction of rural life by big agriculture and industry, and the loss of irreplaceable human and ecological systems.

The everyday enemy of the peasantry is the same as that of all of us: climate change. It brings rising temperatures, droughts, more violent storms and many seasonal irregularities. Rains do not come at the time seeds need to be planted; unseasonal rainstorms ruin crops and encourage the spread of pests. What peasants really need is a vast programme of climate-change adaptation, which will primarily involve switching to other varieties and crops. Such adaptation, however, requires capital. Farms need to be remade; new botanical stock is required; there needs to be provision, as in any experiment, for failure. Given the scenario described, it is not surprising that most farmers cannot raise the necessary capital.

Traditionally, peasants returned nutrients to the soil in the form of vegetable residue, human and animal excrement, decomposed skins and fibres. Since most agricultural products are now consumed in cities, much of that material accumulates as urban sewage and garbage – and the only way nutrients may be restored to the land is in the form of chemical fertilisers. Over time, this causes soil fertility to decline. In my own field research, I have seen farmers weep over the damage they have done to farmland with chemical inputs. Unlike corporations, peasants cannot just shrug at the exhaustion of a particular expanse, and move on. Their plot came to them from their ancestors, who bequeathed also a sacred responsibility.

The fact that the world’s arable land stock is so severely impaired today should be cause for enormous alarm. If the peasant economies of Latin America, Africa and Asia are destroyed, our food system will collapse. Given the vast numbers involved, meanwhile, even small ecological deteriorations may force millions of new refugees off the land. Depending on how things progress, the UN International Organization for Migration forecasts there will be between 25 million and 1 billion climate refugees by 2050. Those people will not likely find offices or factories in which to work. History suggests that some will be forced to extract a living by force, joining militant groups funded by smuggling, kidnapping and extortion. The global political balance is already fragile.

Predictably, agribusiness presents itself as the solution. The websites of big food companies depict happy plantation workers in corporate uniforms. They boast of their commitment to ‘sustainable’ or ‘regenerative’ agriculture. Such companies as McDonald’s, Bayer, Mars and PepsiCo are part of an agribusiness taskforce within the Sustainable Markets Initiative, which declares its aim of engineering a more sustainable and resilient global food system. ‘We can only achieve this,’ explained the CEO of Bayer in 2022, ‘if we as an industry collectively step up our efforts to adopt regenerative farming practices.’

Even if such statements are sincerely meant, the past 40 years should make us suspicious. The partnership between large corporations and the global peasantry has enabled the former to capture revenues from the latter, and so to remove much liquidity from the global countryside itself. The people who live there, whose most precious assets are located there, and whose livelihoods are bound up there, have seen their capacity for responsible management and investment catastrophically diminished. The only real solution is to hand responsibility to those people who have a life-or-death stake in regenerative farming.

The peasant way of life is a critical buffer against climate change. Peasant villages recycle biochemical waste back to the land; many peasants also supply their nutritional needs from their own farms. Peasants, who directly manage about 10 per cent of the land on Earth – an area five times larger than all towns and cities – supply a countervailing principle to corporate extractionism and short-termism. They also preserve critical local knowledge of land and weather systems, and the interactions of plants and animals. The peasantry is one of humanity’s most crucial economic, social and ecological resources, and we need to invest in it if we are to flourish. Affluent and innovative, this class will insulate us from more extreme degradation of natural systems. Impoverished and terrorised, it will be forced, in the end, to leave the land en masse, with manifold catastrophic consequences.

In 1979, writing from a remote village in eastern France, John Berger observed that the objective of the peasant was

to hand on the means of survival (if possible made more secure, compared to what he inherited) to his children. His ideals are located in the past; his obligations are to the future, which he himself will not live to see.

We all would do well – survival may depend on – generalising Berger’s apt characterisation of the peasant relationship to life and land. The crisis of the global peasantry sits at the centre of all other crises, and we have to solve it. We must put peasants back at the centre of our worldview. Their struggle to hold on to their vital place and role is our struggle. A species struggle.

#### Ag resilience interrupts the mechanism for all other x-risks.

Jessica Moersdorf et al. 23, Jessica Moersdorf, affiliated with Justus Liebig University Giessen and ALLFED, specializes in Landscape Ecology and Resources Management; Morgan Rivers, part of ALLFED, focuses on disaster-related food systems; David Denkenberger, affiliated with ALLFED and University of Canterbury, specializes in Mechanical Engineering; Lutz Breuer, part of Justus Liebig University Giessen, focuses on International Development and Environmental Research; Florian Ulrich Jehn, affiliated with Justus Liebig University Giessen and ALLFED, specializes in Landscape Ecology and Resources Management, “The Fragile State of Industrial Agriculture: Estimating Crop Yield Reductions in a Global Catastrophic Infrastructure Loss Scenario,” Zenodo, 07/31/2023, DOI.org (Datacite), doi:10.5281/ZENODO.8198966

The development of agriculture was a major turning point in human history. By offering a stable food source throughout the year, agriculture facilitated the emergence of complex societies all around the globe (Smil, 2017). Agricultural practices developed simultaneously in multiple different cultures, but yields were low and crop production labor intensive: despite its merits, food production in agricultural societies still required the involvement of most of the population to feed everyone. It was not until the rise of modern technology which allowed the harnessing of energy from fossil fuels and its introduction into agriculture in the shape of machinery, artificial fertilizer, and pesticides during the twentieth century that human populations could grow into the billions. This stark increase was supported by an expansion of cropland by 40% (Cao et al., 2021) and by substantially decreasing the number of human work hours required to produce one ton of grain from 30h/t in 1800 to just 90 min/t in 2000 (Smil, 2017).

But the rapid agricultural and societal development has severe consequences, like devastating environmental effects (Steffen et al., 2015), challenges related to climate change (Wiebe et al., 2015), and the decreasing rates of yield increase (van Ittersum et al., 2013), that also interact with each other. One crucial aspect, however, has been underreported in the literature: The advances of modern technology in agriculture have also resulted in a strong dependence of food security on global trade and industrial infrastructure (Neff et al., 2011). This makes the system vulnerable to events in which industrial infrastructure is disrupted. Especially on a global scale, the impact can be disastrous. The COVID-19 pandemic has demonstrated that events deemed highly unlikely can still occur at any given time and has exposed the lack of preparedness in most countries (Liu et al., 2020).

Research in recent years has highlighted the importance of one critical system for human survival in case of global catastrophic risk (Bostrom & Cirkovic, 2008): the food production system (Avin et al., 2018; Baum et al., 2015). Avin et al. (2018) argue that it is affected by most global catastrophic risks and that it constitutes the mechanism by which many global catastrophic risks endanger humanity’s survival, namely by compromising agricultural production to the point of mass starvation. Society is highly dependent on modern agriculture as it enables most of the population to occupy themselves with tasks beyond food production (Coates, 2009; Diamond, 2011). This remarkable surplus in food and energy production can only be maintained through high external inputs into the production system in the form of machinery, fertilizers, and pesticides (Alston & Pardey, 2014). The importance of external inputs differs notably by country as there is no one uniform agricultural production system and stark differences between countries and world regions remain. However, the global food production system can be identified as a fragile system (Manheim, 2020) which is prone to systemic cascading failures (Goldin & Vogel, 2010; Helbing, 2013). Hence, even countries with lower industrial dependence are part of the increasingly connected global system and thus, likely to be subjected to the ripple effects of cascading failures. These properties, high industrial dependence and global interconnectedness, have only developed within the last 100 years but have quickly disseminated and profoundly and lastingly changed society.

This work examines the anticipated change in agricultural yield in a catastrophic infrastructure loss scenario. The underlying premise of all possible causes for catastrophic infrastructure loss is a global-scale disruption of the electrical grid. Given the widespread dependence of global industry and society on electricity, a global electrical failure would essentially bring most industries and machinery to a standstill. The four main potential causes for global catastrophic infrastructure loss include:

● High Altitude Electromagnetic Pulses (HEMP) result from nuclear detonations high in the atmosphere. They cause no immediate harm to humans but can almost instantly damage electronics. Detonating a nuclear warhead emits gamma rays that interact with the atmosphere, creating an intense electromagnetic pulse (EMP) spreading at light speed. The disruptive EMP causes electronics to suffer overvoltage, like a more powerful lightning strike (Wilson, 2008). The affected area depends on the detonation's power and altitude; Wilson (2008) suggests one detonation could affect the entire contiguous United States. Multiple warheads during a nuclear conflict could lead to a global catastrophe. Recovery would likely be difficult, as critical infrastructure like large power transformers are often highly customized and currently need 12-24 months for production (Cooper & Sovacool, 2011).

● A similar risk is posed by solar storms. Solar activity during storms can present itself in the form of solar flares, coronal mass ejections or both. Solar flares are bursts of x- and gamma rays and extreme ultraviolet radiation which can disrupt communication technology (Baum, 2023; Cliver et al., 2022). Weiss and Weiss (2019), however, rate it as a minor risk and rather emphasize the effect of coronal mass ejections on the American power grid. This type of solar activity releases supercharged plasma particles towards earth, creating a geomagnetic storm which acts like a natural EMP towards the electrical grid with potentially devastating consequences (Baum, 2023; Cooper & Sovacool, 2011; Talib & Mogotlhwane, 2011). Like HEMPs, coronal mass ejections can permanently damage large power transformers and thus potentially cause power outages lasting for years (Cooper & Sovacool, 2011).

● Globally coordinated cyber-attacks on many electrical grids or critical industrial infrastructure pose a threat on a global catastrophic scale. Among the various systems under attack, power generation is a prime target for these cyber-attacks (Ogie, 2017). Until now, such attacks have been relatively limited in scope, but there is concern that more advanced and motivated actors could cause significant damage and disruption to these essential systems on a larger scale.

● An extreme pandemic could cause people to be too fearful to report to work in critical industries, resulting in a collapse of the power grid and other infrastructure, as maintenance ceases (Denkenberger et al., 2021).

Apart from the specific scenarios described above, the fragile world hypothesis introduced by Manheim (2020) can also induce or aggravate a loss of industry scenario. Manheim (2020) states that the world has become increasingly more complex, interconnected and most importantly less resilient. The economy’s incentives to minimize redundancy have led to systems becoming progressively more fragile and hence more vulnerable to disruptions. Moreover, fragile systems can significantly worsen the impact of one of the loss of industry scenarios by leading to faster and more severe systems’ collapses during a catastrophe.

### Modeling ADV---1AC

#### Advantage two is MODELING.

#### India imported the American farmworker coop system wholesale---this liberalization significantly improved service delivery but led to oligopoly, unstable prices, and exploitation. Strengthening legal protection for collective bargaining by end producers is goldilocks, mitigating both private AND public centralization costs.

Nilabja Ghosh 13, Agricultural Economics Research Unit, Institute of Economic Growth, New Delhi, Delhi, India, "International Perspectives and Lessons Gained," India's Agricultural Marketing: Market Reforms and Emergence of New Channels, India Studies in Business and Economics, Springer India, 2013, pp. 29-42, DOI 10.1007/978-81-322-1572-1\_3

3.1 What Experiences in Developed Countries Convey

The roots of reforms in agro-markets signifying a rebound from their state subservient status can be found in the west. In particular, the USA is a forerunner that has gained considerable experience in liberalized food marketing. The marketing system is however far from uniform in the western world, and the experiences in different western countries demonstrate that implications of alternative systems still beg resolution. For instance, grain has been a central component in the development of agriculture in the USA and Canada, but there is little consensus on whether the reliance on a few large multinational giant firms is in the best interest of the US farmers and also whether the Canadian marketing system should ideally allow space for greater private participation (see Notes for an overview of the marketing systems in the two countries).

3.1.1 The Relevance of Transparency and the Demise of Spot Prices

The free trade tenet is advocated by subscribers of neoclassical economics for the objectivity of its price signal and the transparency of transactions. Even in the modern and much modified milieu, distortion of the price signal is seen as the biggest weakness of state interference in markets. Yet a comparison between the US and Canadian cases did not succeed in defending any such assertion.

McCalla and Schmitz (1979) emphasize that ‘beyond the superficial’, what actually transpires is much more complex than what meets the eye. The system appears much more transparent in the more state-controlled Canadian system where costs of marketing and salaries of personnel are required to be published officially while in the USA, access to complete and reliable information on grain marketing cannot be placed on public domain with full assurance. Although a recent legislation requires private companies to report sales above a certain magnitude, how this commitment can be enforced still remains a challenging question especially when various evasion possibilities are open to multinational companies operating across the globe.

Experiences of developed countries also suggest that the rise of contract marketing has made price information not only less available but more intriguingly, also less relevant. Increasing product differentiation and the complexity of measuring and verifying product quality make reported prices less illuminating on what to produce and even when to exit the farm sector. Price, as understood from the neoclassical economic literature, is the outcome of demand and supply forces working in the market for homogenized commodity and is best discovered through suitable forms of auction. With product specificity and the presence of small groups of buyers and sellers, the issue needs a degree of reconceptualization, and pricing process is required to be tailored to the context. When the contract takes place, a contract price is determined by mutual bargaining which means relative strengths of the negotiating parties and the information base each has access to at the time are the key forces acting on price determination. The fall of the spot prices that have served for years as a signal to the producer could be a symptom of impending difficulty for policy makers in coming times.

3.1.2 Entry Barriers Again and Producer Defence

While prior contracts with buying companies help producers to hedge price risk and access both technology and a wider market, the reach of the system at the upstream end is widely shown to be confined only to limited sections of farmers. Contracting restrains producers outside the contract from accessing the supply chains (Hobbs and Young 2000). Even if joining the chain were an option, because, severe contractual obligations weigh down on the participating producer and relevant information on the actual functioning of the channel is scarce to outsiders, the decision to join and the task of choosing the supply chain are not simple for the non-participating producer either. The market power structure that evolves from such choices defies full comprehension.

Stringent requirements of sophisticated production skills and tacit actions favouring bulk sellers rather than small farmers are known to constrict the entry into the chains of producers except the most resourceful and the privileged ones. In effect, the oligopsonistic forces inherent in the contractual system become the alternative to the ‘survival of the fittest norm’ that traditionally describes competition. With powerful trading companies finding easy membership, the market committees of emerging channels too become less representative.

The possibility that large contractors will use their market power to turn contract conditions against producers has motivated producers to form associations to bargain collectively in a way similar to labour unions. Producer organizations in Europe, the Agricultural Fair Practices Act (AFPA) in the USA (along with supplementing laws passed by the federal states), Farmers Legal group in Minnesota, legal protection of producer rights extended by Canadian government and National Farmers’ Union and other initiatives to develop standardized practices in the UK are some of the examples in which market fairness is sought to be maintained by this means.

This trajectory despite its usefulness has its own threats for development. Evidences of unions becoming too demanding and aggressive for the viability of the sector and the welfare of the workers they serve and more specifically of the workers operating outside their pale are ample in industry. The government’s role in modulating and balancing the practices assumes importance in different ways in this regard. In developing countries, the task of uniting farmers into collectives is not an easy task given that farming has traditionally evolved as independent and generally family-based activity quite unlike the regimented cadres of factory-based industries. Organizing legal support for this large mass of farm operators, even if united, is even more daunting. The presence of a large number of small farmers with their low levels of awareness, the deviation of the new system from the familiar and long-standing one and the profound complexity of informational asymmetries between the two parties make the reconstitution of developing agriculture into its new incarnation a historic step.

3.1.3 Loss of Independence

The transformation of the US agriculture from a body of traditionally independent farmers to a vertically integrated system with the farmer as a mere component in the channel has yielded valuable experiences to other countries. For instance, producers of peanut and tobacco traditionally functioned as independent decision makers protected by federal programmes. In the case of poultry, another major activity in the US agriculture, chicken was historically reared on most farms that were diversified and supported by thousands of small competing family-owned hatcheries, feed mills and processors.

As production contracts gradually gained ground, federal programmes faced deep trouble. Fixing guaranteed prices to peanut farmers in practice since the 1930s radically changed in 1996 when the legislated price floor was cut by 10 %. The situation was different in the case of tobacco where the decline that is in process since the 1950s intensified by the political and legal pressures of the 1990s. In poultry, the dispersed system of chicken farming and hatcheries radically transformed into horizontally and vertically integrated agribusiness farms and production contracts. However, the transition has yielded reasonable income levels. Tobacco farmers, faced with depressed demand and deeply ethical constraints, found support in alternative avenues as a fallout of the developments. Farmers in less productive regions actually emerged successful because they got access to better technology and marketing support. Yet, in spite of the dividends, discontent arises from the fact that farmers are treated like ‘less than’ employees rather than entrepreneurs. They have forfeited their traditional freedom of taking the decisions to adopt a technology.

3.1.4 Implications for the Urban Consumer

Supporters of the fast-growing modern food retail sector (UNIDO 2009; Shepherd 1965) argue that this sector has so far been unduly suppressed preventing benefits like economies of scale, globalized procurement and thereby expanded product choices from reaching the consumers. This argument is however easily critiqued for its consumer-centric emphasis. A patent disregard of the political implications for urban unemployment due to the displacement of existing suppliers is another charge. The capability of the modern retail system to cater to the demands for fresh food is questionable. Evidences show that supermarkets prove more successful in selling processed foods and staples but fall short of informal vendors in the quality standards of fresh food (Reardon and Minten 2011). In the downstream end too, the reach of the channel across different consumer classes is likely to be limited. In the face of growing concerns over deteriorating food habits, obesity and loss of nutrition whether the urban consumer really gains is unanswered when the product purchased is seen in a broader perspective.

3.1.5 Agro-ecological Prophesy

A clash between peasant agriculture and the agribusiness model relying largely on contracts between producers and buyers is intensely critiqued by agro-ecologists. Input application in farming in modern chains is largely external and driven by recipes provided by external sources as against the closed peasant system in which input use, based on principles of biology and individual experience, incorporates flexibility, adaptation and resilience. Farmers’ purposeful responses to various factors as reflected in their day to day decisions are seen to be the key to sustainability of agriculture. Extension in agriculture lies at the crossroads given the apparent contradictions between sustainability and profitability.

The agro-ecological approach would rest on an extension system that is led by the farmers themselves rather than private entities or even the state. Exchange of ideas, adaptation and documentation of best practices are deemed as ideal principles for sustainable agriculture. When farmers lose their power of independent decision making, any mistake on part of the provider can mean disaster or bankruptcy with little leeway for redemption. Even as public extension, as a means of delivering proven laboratory techniques and socially oriented formulas to the field, loses relevance, it is observed that the contracts incorporate hardly any provision for training and extension. The sponsors generally favour commercial crops forcing farmers to be dependent on market for their food security. With intensive use of chemicals to attain high yield rates, their land is liable to become unsuitable for food cultivation over time making the process nearly irreversible.

A recent study conducted by the Institute of Mechanical Engineers suggests that as much as 50 % of food products around the world never reach human stomach (Fox and Fimeche 2013). One third of UK vegetable crops are not harvested due to them failing to meet the exacting standards based on their physical appearance. Consumers also throw away half of the purchased food in Europe and the USA. Poor engineering and agricultural practices as well as inadequacy of storage facility even in the organized sector are reflected in the wastage. The sales strategies tacitly encouraging consumers to overbuy through supermarket schemes (such as buy 1 get 1 free) are symptomatic of these difficulties. Producing food imposes pressure on resources like land, water and energy, and with the need for feeding three billion people by the end of the century looming large, the loss of food through wastage needs to be contained by sustainable ways of operation from farm to market and from market to consumers. How far the private sector-driven, contractual and recipe-based farming system fits with the emerging global concerns is not resolved.

3.2 Experiences in Developing Countries and Transitional Economies

In the years following 1980 and more so in the 1990s, a number of developing countries were in a process of reforming their agricultures to eliminate price distortions (that most often went against the producers’ interest). The motive forces of the reforms were many, but external impetus possibly dominated the drive while internal resistance slowed down the pace. In the case of some of the least developed countries, independence from food aid was an added objective, in which international agencies provided fuel. Huge debts and external borrowings helped to bring others in the net while the internal burden of market failure, food insecurity and uneconomic surpluses also contributed to the imperative to allow private enterprise and to open up the borders in some countries.

The prereform scenario in developing countries was shaped by the urge to mitigate the problems resulting from poor functioning of agricultural markets inherited from colonial times. In order to stabilize farmers’ incomes, ensure food security and protect smallholders from uncompetitive marketing practices (Dehn 2000; Timmer et al. 1983; Myrdal 1956), regulations and state controls were routinely resorted to in these economies. The recent spate of reforms therefore has not been easy in welfare nations and aroused apprehensions. Land fragmentation and preponderance of small farms raised the spectre of inequality as well as incomplete participation in reforms creating political unacceptability of reforms. Limitation of the land market manifested in inadequate land rights, failure of institutional finance to meet farm requirements, persisting insecurity about food supply especially arising from droughts, urban bias in development and possibilities of unemployment of small traders naturally create resistances against reforms. Administrative weaknesses, corruption and lack of capital and skill were additional deterrents.

Actual implementation of reforms could be influenced by an assortment of complex sociopolitical factors such as forms of governments, ideologies of ruling governments and opposition pressure if political opposition is possible in the system. In democracies, the nearness to election and rural and urban representations in electorates also determine the pace of systems. Other factors include the current openness of the economy, requirement for external loans, persuasion from lenders, economic crises and other compulsion for reforms (Giuliano and Scalise 2009).

3.2.1 African Experiences

In Africa, reforms that started in the early 1980s proceeded along with structural adjustment and democratization. Donor agencies had a significant role in pushing for reforms given an agenda set by the World Bank’s ‘Berg report’1 in 1981. The food markets in these countries were dominated by large state or parastatal agencies.

Reforms were targeted at withdrawal of state involvement in pricing and marketing and relaxation of regulations on marketing. The Ethiopian government curtailed the operation of its state marketing board as part of aid conditionality in 1990. Aid conditionality was also instrumental in commencing reforms in maize market in Kenya in the 1980s. In Zambia, the newly elected government in 1991 withdrew direct government involvement in grain trade and encouraged private enterprise. Reforms started in 1981 in Mali, a semi-desert country, but it was the democratization in 1991 that speeded up liberalization of the cereal market. Multilateral agencies advocated food market reforms in Benin and Malawi in sub-Saharan Africa as a central component of structural adjustment. Although shortening of channel is a central rationale for reforms, in reality intermediaries could not be eliminated in most cases.

Studies show mixed results from reforms. While evidences of increased private involvement, greater market integration and production gains are seen in literature, uncertain state commitment, inadequate private sector response and unimpressive growth impact are the overriding impressions. Market intermediation was taken up by private traders in most cases, but their lack of capital and poor education levels have been serious limitations. On the contrary, service delivery to small farmers severely suffered in areas vacated by the government when private enterprise failed to fill up the gap created as in Zambia (Mwanaumo 1999).

The experience of Mali highlights some degree of success in marketing millets, the importance of infrastructure for storage and transport and the possibility of an interaction between the sectoral reforms and macroeconomic reforms (Dembele and Savadogo 1996). In most cases, foreign capital did not flow in as expected while the number of NGOs grew. Though diversification was promoted, new crops actually proved uneconomic (maize in Zambia) in many cases. In Benin and Malawi, private traders responded but only as petty brokers with poor capital base, low specialization and insufficient access to credit (Gabre-Mdhin 2001). Contract farming, known for mitigating price risk, by and large excluded small farmers because of the high quality standards required by buyers, though pockets of success are noted in South Africa and Zimbabwe where small farmers integrated closely with the market and adopted organic methods (Singh 2012) for gaining advantage in the international market.

However, the records varied. For example, Uganda and Mozambique are countries where governments showed commitment to reforms. Certain countries openly resisted reforms. Zimbabwe reimposed controls on maize after initial experimentation. Veiled reforms with de facto state control were the case with fertilizer market in Zambia and Ethiopia and coffee in Malawi. A reversal was implicit in Ethiopia’s2 course of reforms. Failure was attributed by many to inadequate implementation of reforms (Jayne et al. 2002). In respect of cash crops cocoa, coffee, cotton and sugarcane, the pace of reforms varied among commodities and countries (Akiyama et al. 2003). Econometric analysis suggested that the share of producer prices of coffee was increased by reforms which imparted cointegration between world prices and grower prices (Krivonos 2004).

3.2.2 Centralized Economies

Modern economic theory based on presumptions of well-defined property rights throws little light on the implications of reforms for both the dynamics of the economy and the institutional trajectory of centralized economies. The move towards market economy was undoubtedly a shock to the erstwhile socialist countries which were stagnant and deceptively stable systems to start with. Agriculture in most of the countries in former Soviet Union (CIS), East Europe (CEE) and China was conducted in collectivized farms of large scale although private titles were not unknown in some of the constituent countries. Failure of agriculture was also an important if not a central reason triggering reforms in these economies.

The CIS and CEE countries, breaking out of the centralized control of communist regimes in a bipolar world in 1990–1991, had much to learn from experiences of developing countries. They differed from developing countries however mostly in the scale of cultivation, nature of land titles, ideological biases against markets and administrative difficulties of the revolutionary regime change. The large farms associated conventionally with economies of scale had laboured under the weight of transaction cost of monitoring and enforcement and the problems of moral hazard, shirking and free riding. Land privatization became a major component of the agenda. Nevertheless, large-scale collective or corporate farms continue to be important in most of the transition economies, with unresolved debates over land transfer persisting in many countries including Russia.

The agricultural transition was aimed at improving efficiency and productivity of farm production through the replacement of the institutional and organizational rigidities of the former command economy by market-oriented institutions. Downsizing of scale and greater individual accountability were the cornerstones of the change. Despite the weight attached to land relations, transitions are intrinsically multidimensional. As a result, indices had to be developed by multilateral agencies like the World Bank to capture the progress of reforms in dimensions such as price and market liberalization, privatization of agro-processing, development of financial markets and creation of market-oriented institutional framework for agriculture. These countries however shared common institutions with developing countries like state enterprises dealing in food procurement and distribution and the associated compulsions imposed on agriculture so that sharing of experiences retained its relevance.

Although privatization of the agricultural environment has proceeded in the European countries with an impressive success of the food industry achieved in Hungary despite lags in Bulgaria, Romania and ex-Yugoslavian countries, the complexities prevailing in the former Soviet Bloc countries such as corruption and bureaucracy led to a technological decline in the food industry and discouraged the inflow of foreign capital (Csaki 2000). Emerging evidences suggest that different policy environments also influenced land reform decisions (Lerman 2000b) in the formerly socialist countries. The CEE countries had marked differences with CIS countries in having smaller agricultural sectors, higher food standards but greater expectations about their level of living, creating demands on the reforms. All this makes assessments dissimilar and incomparable.

In China, food market reforms took place in a gradual way starting with de-collectivization in 1978 when the centralized system gave way to a more efficiency-based approach to marketing (see Notes). The new system remained flexible and sensitive to demand situations but with ‘retrenchment’ in reforms taking place whenever it was felt necessary. The motivation for liberalization arose when the system of procuring grains at depressed prices entirely for rationing in urban areas failed to encourage production to meet the growing needs of the urban populace. Empirical investigations in wheat market suggest that the efficiency of Chinese market improved over time (Wu and McErlean 2003). China has achieved a fair measure of success with the reduction of government control on agricultural markets and the vitalization of price mechanism, but vibrant wholesale food markets and governmental minimalist price intervention in select foodgrains remained important cornerstones in the transition.

Cuba’s experience was different. In Cuba, productivity in agriculture is perceived to have improved in early years of the revolution due to rural investments, but concentration in sugarcane cultivation built up a dangerous export dependency. The temporary attainment of food security which was different from food sovereignty (Rosset et al. 2011) created difficulties when the supporting socialist block collapsed followed by the US trade embargo in 1989. However, the country adopted a less external input-based and more diversified system although accepting the breaking up of state farms that were deemed incapable of this adjustment. The emerging extension system also developed more autonomous peasant agriculture where inputs were chosen by farmers’ own judgment and not by prescriptions provided by corporates or government agencies.

Myanmar, in Asia, was an inward-looking country. Harsh controls on an agriculture crowded with landless labour and more severe controls on rice marketing were a means of social control. Liberalization in 1987–1988 led to a relaxation of state control, removal of levies and entry of private intermediaries in the markets for cash crops pulses, oilseeds and beans. Export possibilities to India and the lack of political significance of these specific exportable crops especially pulses proved to be advantages for reforms. Impressive expansion of acreage, increase in productivity and trade followed. Input payments and also price contracts made in advance enabled by the reforms facilitated the success (Okomoto 2004). The effects of further political changes in the country remain to be seen.3

3.2.3 Challenges Awaiting India’s Public Policy Making

The urgency for India’s economic reforms arose from the poor functioning of the - state-controlled or ‘regulated’ markets and a financial crisis that necessitated borrowing from international agencies and a restructuring macroeconomy in 1991. Reforms in agriculture were a part of the process but were more difficult to implement than those in other sectors like trade and industry. Opening up agricultural markets is perhaps an even more daunting task. However, the historical Act of 2003 opened the gates for new channels to form in agri-marketing, but the path is yet long and fraught with debacles.

Amendment of the Agricultural Produce Marketing Act in India brings the relatively backward and poverty-ridden yet politically the most sensitive sector agriculture in close encounter with the new world of capitalism. Allowing varied channels of marketing agricultural goods to emerge could mean ravaging the production systems in place and even obliterating the marketing channels that had evolved over centuries. While excessive suspicions verging on paranoia can be misplaced when evidences of benefits are not sparse in areas where the ground has already been tested, there is enough reason for caution when one critically examines the fine prints.

Inflated intermediary margins in market chains enlarge the ratio of the earnings of non-production workers to those of production workers in agriculture (Goldberg and Pavcnik 2007; Bardhan et al. 2009). Market reforms as a policy in the wake of trade liberalization were motivated by a desire for efficiency. It is also important to appreciate that a new phase of capitalism has dawned bringing with it new complexities, as sweeping changes take place in managerial aspects of product delivery, aided by modern information technology. Curtailing avoidable margins perceived partly as entrepreneurs’ ‘reputational’ rents and partly as returns to managerial skills is also an issue that arouses concern.

Allowing greater freedom to potential traders, be they individuals or large organized conglomerates, to enter the business of agro-trade in ways that are flexible would allow the development of a market that is ‘contestable’, if not competitive, where the threat of competition would prevent runaway profiteering at the cost of producer or consumer welfare. Unproductive marketing costs and margins can be reduced by means of superior technology, improved managerial practices and elimination of redundant intermediaries. The changes could pave the way to greater investment in agriculture, higher production in terms of quality and quantity of output, better consumer satisfaction and higher prices reaching the producer.

Although freedom of markets is a central concern of the reforms, it is also an appropriate time to acknowledge the transitions in capitalism, the erosion of neoclassical beliefs and the demise of price purely as the specific concept that had been nurtured over the centuries and studied in economics. While even that notion of price was a victim of oversimplification in the presence of uncertainty and transaction costs (Coase 1937) giving rise to organized firms, the overwhelming desire to overcome unavoidable costs in the wake of the information revolution would generate new innovations (such as greater vertical integration, electronic transactions, prior contracts over price, production and quality, markets for risk and derivatives and a deluge of retail networks, franchises, telemarketing, e-selling and virtual selling), leading the pricing process to attain a new platform. As with firms, vertically integrated segments of marketing channels, can appear as collusions or function as ‘command economy microcosms’ making use of coercion-based mechanisms to minimize transaction costs and leave footprints in the power relations among channel members but in lesser public scrutiny.

The public policy needs to be prepared for challenges and complexities that would be novel. That reforms in agricultural market would lead to unpredictable dynamics, the emergence of organizational variety and nonstandard and unfamiliar business practices (Williamson 1985) is hard to refute. Public policy will also have to perceive the gradual shifts and act in concordance. With contracts stipulating rigid farm practices, the place of public extension has to be reinvented. In the same way when patents are awarded to innovations, the role of public research and development has to be redefined and aligned with the situation.

Yet any diminution or vacation of the public space could be disastrous when short-term profit-motivated instructions conflict with sustainability concerns or where intellectual property rights of rich companies deprive small producers of their rights to basic livelihood. Longer term and more profound questions on the merit of industrializing agriculture into mechanical assembly lines from independent decision making entrepreneurial units and its effects on ecology and human resources are not less discomfiting. The catastrophic possibility of the powerful entities deserting producers in distress or leading the way to food insecurity needs contingency provisions.

The decline of spot pricing and the challenge to our notion of prices would be a hard onslaught on policy making. The transparency of market information and even the relevance of the same would be a possible grey area to be prepared for. Food prices have guided the policy makers in making welfare plans and assessing fair practices and efficiency. With the close relations within the channel and the quality differentials difficult to measure, such reporting of market prices would be more difficult to access and quantify. Market intelligence reports can become less representative while information acquisition, processing and dissemination will require to be technologically more enabled. Asymmetries of information would be highly likely when one of the parties has access to the global market information. The traditional traders competing with one another and bearing personalized ties with sellers were a dominant source of price information for the producer, and their elimination can mean a severe damage to the information system. Whether the public information system or technology can fill up the gaps can be reviewed.

Rural markets are yet unequal, dotted with innumerable small and unorganized farms. Unfair terms in contracts are more likely to be imposed by the powerful buying organizations, and lack of transparency can make it difficult for the administrative process to monitor. Superior legal, managerial and financial resources with the traders increase the vulnerability of the producers to unjust contracts and the susceptibility of state officials to fall prey to unethical manipulations.

Official requirements of making contract terms public must be mandatory in practice but not easy to implement in spirit. Besides, rising incidences of disputes between contractors are also an additional challenge requiring restructuring of the judicial machinery to rise to the occasion. Some states in the USA require mediation prior to presentation of the case in court and specification of the arbitration procedures in the contract itself. Obligations to follow prescribed methods of cultivation, feeding animals, documentation and farm audits demand an altogether different set of skills of the producer as compared to traditional spot market where transaction was fairly straightforward. Resolutions of conflicts are also no easier in the new situation.

Organizing producers to gain bargaining strength and remedial power is a mechanism commonly considered essential for the success of the emerging system, but complications of excessive demands, unreasonable expectations and unmanageable volumes of arbitration cases are not unknown in developed countries. When producers are at a bargaining disadvantage, the economic outcomes could be efficiency only at the cost of welfare loss that the government has to manage. In the developed countries, competition and antitrust regulations play pivotal role in these matters, but this is by no means easy especially in Indian context. In the absence of clear price information and measuring protocols for quality, regulation could be a far more ominous challenge for developing countries.

The experiment with new marketing channels involving contracts in the western countries serves as eye opener for the developing countries that have embarked on the same path. Earlier, the advent of capitalism in a rural semifeudal agro-system in developing countries could not purge the system of class relations and nested agronomic processes that lead to interlocking in the markets. Those issues remain although they were mitigated by state intervention in the form of direct participation in markets, regulation of private trade-led markets and creation of markets where such markets failed to emerge.

The dismantling of the state activism and permission of the new capitalism to enter into agro-markets will unleash the embedded agro-markets in a new reincarnation manifested in vertical integration, contracts, consortiums and alliances. Together, the giant system would dominate the agriculture of today and tomorrow and decide the fate of small farmer welfare and food security of the nation. However, it is also pragmatic to note that the new capitalism may have less to do with competition than with collaborative and oligopolistic behaviour in a ‘competition-obsessed business culture’ striving to search for ‘returns to equity’ where large and powerful players can collude, deter entry, curb competitive innovations and influence not just markets but also policy (Meyer and Kirby 2012a). Gaining mileage from the potentials and containing the negatives would be the way forward in India to deal with the transition.

#### Climate shocks generate an acute need for new US models---Indian farmers are adopting new tech BUT that won't solve without bargaining power.

Pooja Singh & Vernika Mishra 24, Singh and Mishra are affiliated with Amity School of Economics, Amity University, Greater Noida, India, "Crisis on the Vine: Unraveling India's Tomato Price Surge Amidst Weather Extremes and Food Security Concerns," International Journal of Energy, Environment, and Economics, vol. 31, no. 4, 2024

Climate change is creating food price inflation, which disrupts the stability required for economic development and social cohesiveness. Erdogan, Kartal, and Pata’s (2024) paper in “Foods” examines the mechanisms aggravated by climate change, emphasizing the complex relationship between environmental changes and economic effects in the food industry.

Similarly, the intricate relationship between climate vulnerability and agricultural stability has been brought into focus by the recent surge in tomato prices across India. In cities like Delhi-NCR, Bengaluru, and Kanpur, the prices have skyrocketed to INR 80 per kg and even higher. This surge can be directly linked to the lack of sufficient rainfall and the subsequent onslaught of intense heatwaves experienced from April to June in 2023. Experts widely attribute this unprecedented meteorological pattern to the larger issue of climate change, which is significantly impacting the agricultural landscape of the nation. (see, Hindustan Times, June 27, 2023).

In the same vein, through alternative energy sources, for example, renewable energy, clean fuel, green and low carbon emission technology, pollution in the atmosphere can be reduced (Khan, Y & Khan, M (2021)). The strong connection between greenhouse gases and changes in climatic conditions is well-known, as climate change strongly impacts climate and increases its vulnerability. Among greenhouse gases, carbon dioxide (CO2) stands out as a major gas that harms the environment and influences human well-being (Ansari, T & Ansari, Z (2022)).

Climate Change’s Impact on Agriculture

The effects of climate change have resulted in an intricate network of outcomes across different industries, with agriculture being significantly affected. A research study titled “Mitigation of Climate Change’s Influence on Vegetable Crops” highlights the vulnerability of the agricultural sector to these changing weather conditions. The shifting climate has led to crop failures, decreased crop yields, compromised produce quality, and increased susceptibility of crops to pests and diseases. (Mahato, 2014, {Kurukulasuriya2003}) As a result, vegetable cultivation, including the cultivation of tomatoes, which hold great cultural significance in India’s culinary traditions, has become less economically viable.

Tomato’s Susceptibility to High Temperatures

Tomatoes are highly affected by changes in temperature, which makes them extremely vulnerable to the intensified heatwaves caused by climate change. Not only does high temperature impact the size and color of tomatoes, but it also disrupts their reproductive growth. (Xu, J., Wolters-Arts, M., Mariani, C. et al, 2017) The reproductive phase of tomato plants is more sensitive to elevated temperatures compared to their vegetative growth. Even a slight increase in temperature, as little as 2–4ºC, can significantly disturb crucial processes such as pollination and fruit development, resulting in significant decreases in yield. Additionally, excessive heat hampers the formation of floral buds and the essential process of photosynthesis, further worsening the challenges faced by tomato crops (Alsamir M, Mahmood T, Trethowan R, Ahmad N, Adams2001).

Additional Climate-Induced Challenges

The obstacles confronted by tomatoes because of climate vulnerability go beyond just heatwaves. Cold temperatures and various other climatic irregularities, including flooding, salinity, and waterlogging, exacerbate the difficulties faced in tomato cultivation. These cumulative challenges contribute to an intricate environment for farmers, affecting productivity, quality, and overall economic sustainability Adams, R. M., Hurd, B. H., Lenhart, S., & Leary, N. (1999).

Government Initiatives and Technological Innovation

The Indian government has taken proactive measures to address the threats posed by climate change on agricultural yields and pest vulnerabilities. The establishment of the National Research Foundation (NRF) with a significant allocation of INR 50,000 crore highlights the importance of climate-smart agriculture (CSA) as per the National Research Foundation Bill, 2023. This initiative aims to utilize dedicated research to strengthen climate adaptation strategies.

To combat the negative impacts of greenhouse gas emissions resulting from imbalanced chemical fertilizer use, a cap of INR 3.69 lakh crore has been imposed on fertilizer subsidies over three years (M. 2024, February 1). This redirection of potential savings aims to support agricultural practices that are resilient to climate change.

Additionally, the exploration of innovative technologies such as drones, sensors, artificial intelligence (AI), and the Internet of Things (IoT) is underway to enhance agrifood production, post-production management, and agro-processing. These technological interventions offer promising opportunities to steer India’s agricultural sector towards greater sustainability and resilience in the face of impending climate vulnerabilities. (FAO 2020)

In order to effectively address challenges like soil fertility loss, land degradation, and declining productivity, it is crucial that research, development, and technological integration efforts are aligned with specific crop requirements and regional contexts. By doing so, India’s agricultural sector can overcome the challenges posed by climate change and secure a more resilient future.

Economic and Social Implications

The increase in tomato prices in India is not just a random economic anomaly; it has farreaching effects on households and communities, exposing an intricate network of economic and social outcomes that highlight the crucial significance of tomatoes in Indian diets and everyday life (Online, E. (2023, July 18).

Impact on Households

The tomato price hike has had a profound impact on households throughout the country, with significant socio-economic repercussions. A recent survey conducted by Local Circles, which covered 11,000 households across 309 districts, has revealed some alarming findings. Shockingly, one out of every three households had to pay more than INR 200 per kilogram for. This unprecedented increase in prices has not only changed consumer behavior but has also forced many households to make difficult decisions. The survey further highlighted that 10% of respondents paid more than INR 250/kg, while 23% fell within the range of INR 200 to INR 250/kg. In a worrying trend, 17% of households even stopped purchasing tomatoes altogether, which clearly demonstrates the severe impact of the price surge tomatoes (Joshi, M., Circles, L., & Circles, L. (2023, August 8).

Despite efforts by organizations such as the National Cooperative Consumers’ Federation of India (NCCF) and the National Agricultural Cooperative Marketing Federation of India (NAFED), the upward trend in tomato prices has remained relentless. The Reserve Bank of India (RBI) has expressed its concern, attributing the surge to disruptions in supply caused by adverse weather conditions and pest attacks. This price volatility holds historical significance as it affects inflation and has a ripple effect on the prices of other vegetables in both retail and wholesale markets (See Business Standard 2023, July 17). With logistical challenges affecting the supply of government-subsidized tomatoes, a staggering 89% of households found themselves purchasing tomatoes at prices exceeding INR 100/kg, and one-third of them had to pay over INR 200/kg (FNB News. (n.d.).

Food Security Concerns

The tomato price crisis not only causes economic concerns, but also prompts reflection on the state of Indian agriculture and overall food security. The sight of farmers discarding excess produce in protest highlights deeper underlying problems that go beyond mere economics. This crisis also affects urban areas, where high tomato prices pose a risk of malnutrition, particularly among vulnerable urban populations. The severity of the situation is evident from the fact that even a fast-food giant like McDonald’s has been compelled to remove tomatoes from its menu due to their inflated costs, demonstrating the wide-ranging consequences that extend to international brands (Shan, 2023).

However, the tomato price crisis is not solely a result of supply and demand dynamics. Unpredictable climate patterns in the current year, characterized by untimely rainfall and cyclonic storms, have disrupted tomato cultivation, especially in southern and coastal regions that are typically reliable contributors to the tomato supply. Excessive rain has hindered plant growth, resulting in yield losses due to disrupted pollination during crucial flowering and fruiting stages. The lack of climate contingency plans for essential food crops and food security has further worsened the issue (Shan, 2023).

Considering the current crisis, the government has implemented various measures, including the TOP (Tomato-Onion-Potato) program as part of Operation Greens (MOFPI, Greens Short Term Intervention, June 2020). This initiative is designed to enhance the efficiency of supply chains and minimize losses after harvest by providing subsidies for transportation and appropriate storage facilities. The primary objective is to address the inherent weaknesses in the supply chain and alleviate the burden on consumers. Nevertheless, the broader socio-economic implications of this tomato crisis on food security present a complex challenge that requires comprehensive solutions to ensure the resilience of the nation’s food systems. One potential approach to controlling the tomato crisis is the adoption of crop production robotization, which involves the use of robotic harvesters and optimized field practices to enhance tomato production. (Omokaro, Idama & Uguru, Hilary (2021))

Rationale of the Study

As mentioned above, it has been observed that there are variety of factors that contributes to the Tomato price hike that seems to be influenced by various social and economic implications. In this present study the following questions have been raised which need to be verified in accordance with the documented interviews published on social media, E-Newspapers, magazines, blog.

1. How the sentiments of economic conditions impacting the trend/pattern of tomato price hike?

2. How is price hike affecting the sentiments of consumers?

Research Objective

1. To identify the contributing factors of tomato price hike through systematic literature review.

2. To identify economic and social implications of tomato price hike through systematic literature review.

3. To perform the content analysis from the interviews, opinions and articles published in E-Newspaper, magazines by the help of NVivo.

Methodology

This research paper utilizes a multi-faceted approach to thoroughly examine the intricate issue of tomato price surges in India. The approach encompasses quantitative data analysis, qualitative sentiment analysis, and an evaluation of economic theory.

1. Data Collection: Official sources such as the Department of Consumer Affairs, National Cooperative Consumers’ Federation of India (NCCF), Agricultural and Processed Food Products Export Development Authority (APEDA), The Food and Agriculture Organization of the United Nations (FAO) and National Agricultural Cooperative Marketing Federation (NAFED) surveys conducted by Local Circles, along with government reports on agricultural production and prices, are utilized to collect quantitative data. These sources offer a comprehensive overview of the extent of the price surge, its impact on households, and inflation trends.

2. Sentiment Analysis: Qualitative analysis is conducted using NVivo Software to capture public sentiment and perspectives on the tomato price surge. Social media posts, news articles, and public discussions are evaluated to gain a deeper understanding of the nuances of public opinions and sentiments towards the crisis.

3. Economic Theory Examination: The research paper examines the applicability of the Law of Demand to the tomato price surge. Economic theory is employed to assess whether the inverse relationship between price and quantity demanded holds true for tomatoes, taking into consideration their cultural significance, perishability, and indispensability.

4. Comparative Analysis: A comparative analysis is conducted to juxtapose the findings from quantitative data analysis, sentiment analysis, and economic theory. This crossvalidation enhances the understanding of the complexities surrounding the tomato price surge.

5. Case Studies and Expert Interviews: The research incorporates case studies from regions heavily affected by the surge and expert interviews with economists, agricultural experts, and policymakers. These insights provide real-world context and expert opinions on the causes and potential solutions.

Overall, this multi-dimensional methodology ensures a comprehensive and holistic analysis of the tomato price surges in India.

6. Theoretical Framework Application: The research paper utilizes the theoretical framework of climate-resilient agriculture, price stabilization mechanisms, and socio-economic implications to examine potential resolutions. Through the integration of these approaches, the research paper seeks to provide a comprehensive comprehension of the sudden increase in tomato prices, its socio-economic consequences, the relevance of economic theories, and possible avenues for sustainable remedies.

Sentiment Analysis-Points Derived from (NVivo Software)

Summary Analysis Based on Views and Sentiments Related to the Surge in the Price of Tomato

The recent increase in tomato prices in India has attracted significant attention and raised concerns regarding its impact on household budgets and inflation. The rise in prices can be attributed to a combination of factors, including crop damage caused by unfavorable weather conditions, pest infestations, and logistical difficulties. Tomatoes, which are a staple in Indian households, have experienced a significant price hike, reaching up to Rs 200 per kilogram, placing a financial burden on consumers. The primary tomato-producing regions, such as Maharashtra, Karnataka, and Andhra Pradesh, have been adversely affected by weatherrelated problems, resulting in reduced supplies and higher prices. This shortage of tomatoes has also affected the availability of other vegetables, contributing to a general increase in prices for essential cooking ingredients. In some cases, the scarcity of tomatoes has even led to their removal from certain fast-food menus due to unavailability. Although some relief is expected with the arrival of new tomato crops, the situation is projected to persist, impacting inflation rates and household budgets. The surge in tomato prices underscores the challenges posed by environmental factors and supply chain issues in maintaining stable food prices in India.

[FIGURE 1 OMITTED]

INTERPRETATION:

Figure 1 represents the theme analysis from views which indicates the major points that has been discussed in the views. The major points in views on tomato price hike includes prices, market,saw pest attacks,inflation and many more that is highlighted in the above picture.

[FIGURE 2 OMITTED]

INTERPRETATION:

The recent increase in tomato prices in India has raised significant concerns among both consumers and economists. Unlike discretionary goods that can be easily replaced or avoided, tomatoes are considered essential items that are vital to everyday life and cuisine. This poses a particular challenge for consumers who cannot easily switch to alternatives.

Tomatoes hold great cultural and culinary importance in Indian households as they are a key ingredient in a wide range of traditional dishes. They not only enhance flavor and provide nutritional value but also play a crucial role in achieving the desired texture and taste in various preparations. The versatility of tomatoes in curries, sauces, chutneys, and salads further solidifies their indispensability in the Indian diet.

Given this context, consumers have limited options when it comes to adapting or substituting tomatoes in their meals. Unlike discretionary goods that can be replaced or omitted, the absence of tomatoes can significantly impact the quality, taste, and familiarity of traditional dishes. Such a fundamental change in daily meals is often met with resistance, especially in a country where food is deeply intertwined with cultural practices and family traditions.

The challenge of finding alternatives is further compounded by the fact that tomatoes have a relatively short shelf life and are highly perishable. This makes it difficult to stockpile or purchase in bulk as a means of managing price fluctuations. Additionally, other vegetables that could be considered as substitutes, such as potatoes or onions, have also experienced price increases due to similar supply and climate-related challenges.

In conclusion, the increase in tomato prices presents a unique dilemma for Indian consumers. The necessity of tomatoes in daily cooking, combined with their irreplaceable role in traditional dishes, leaves consumers with limited flexibility.

The tomato’s significant role in Indian cuisine creates a challenge for consumers to replace or remove it, unlike discretionary goods. This underscores the intricate relationship between cultural practices, dietary habits, and economic obstacles. Consequently, the repercussions of the tomato price increase extend beyond economic factors, emphasizing the intricate connection between food, culture, and consumer behavior.

Economic Theory Examination – (Law of Demand)

Based on the aforementioned facts and data, this research paper seeks to examine whether the recent increase in tomato prices adheres to the Law of Demand. The Law of Demand states that, all else being equal, as the price of a good or service rises, the quantity demanded decreases, and vice versa, as the price decreases, the quantity demanded increases. Although this economic principle generally holds true for most goods, the unique role of tomatoes as a necessity in the Indian context introduces certain complexities.

The paper concludes that the Law of Demand may not apply to tomatoes as straightforwardly as it does to other goods. This is primarily due to the deep-rooted presence of tomatoes in Indian culinary traditions and cultural practices. They are an essential ingredient that contributes to the flavor, aroma, and overall experience of various dishes. Consequently, the demand for tomatoes may exhibit a certain level of inelasticity.

Tomatoes are not easily replaceable or substitutable in many traditional Indian recipes. Consumers are often unwilling to compromise the taste, texture, and authenticity of their meals by substituting tomatoes with other ingredients. This creates a situation where even if the price of tomatoes increases, the decrease in quantity demanded might not be as significant as predicted by the Law of Demand.

Furthermore, the perishable nature of tomatoes and their short shelf-life limit consumers’ ability to stock up or delay purchases in response to price hikes. This time-sensitive aspect further diminishes the applicability of the Law of Demand.

In summary, the complexities of the tomato price surge in India, stemming from the cultural and culinary significance of tomatoes, challenge the full applicability of the Law of Demand. While economic theory suggests that higher prices should result in decreased demand, the indispensability of tomatoes in traditional cooking practices and the constraints posed by their perishability create a unique situation.

[FIGURE 3 OMITTED]

INTERPRETATION:

Figure 3 represents the hierarchy tree from views on tomato price hike which indicates that there is more neutral and negative sentiments in Indian economy as tomato plays a pivotal role in Indian cuisine and it is driven by climate vulnerability, supply chain disruptions, and regional disparities, impacting food security.

[FIGURE 4 OMITTED]

INTERPRETATION:

Figure 4 represents word cloud which generated through views on tomato price hike. It depicts the tomatoes is at the centre and is surrounded by words mostly related to demand, consumers, price, and Indian economic challenges.

DISCUSSION

The recent surge in tomato prices in India has created an immediate need for well-defined strategies and collaborative efforts to address the economic and social implications of this situation. As tomato costs continue to rise, several potential solutions and avenues for future actions emerge.

Government intervention plays a crucial role in stabilizing the fluctuating tomato prices. The cyclical nature of low prices, which leads to reduced arrivals and subsequent price spikes, has been evident in historical patterns. This highlights the necessity for consistent pricing mechanisms. Although solutions such as cold storage and tomato processing have been suggested, there are challenges in implementing them. The government’s involvement, particularly through mechanisms like bargaining councils, has the potential to establish fair negotiations and reserve prices, thereby promoting stability in the market. The concept of a Collective Bargaining Council (CBC), inspired by models such as the US Agricultural Fair Practices Act, shows promise in advocating for farmers and enforcing negotiated reserve prices. The key to achieving enduring price stability lies in comprehensive regulatory frameworks that address bargaining imbalances and empower farmers (Bhan, 2023).

In the field of agricultural research and development, innovation plays a crucial role. It is essential to create tomato varieties that are resilient and can withstand the challenges posed by climate change, pest infestations, and market fluctuations. The National Innovations on Climate Resilient Agriculture (NICRA) project is an example of an initiative that shows a dedication to improving agricultural resilience. By developing tomato strains that are droughttolerant, disease-resistant, and have a longer shelf life, we can ensure food security and a consistent supply (Ahire, R. D., Kale, N., Pise, G. K., Ahire, R. D., & Kale, N. D. (2018).). Using technology, scientific knowledge, and collaboration, these resilient tomato varieties can contribute to a more climate-resilient agricultural sector.

Ensuring the accessibility and affordability of tomatoes necessitates innovative approaches. By utilizing technology such as data analytics and predictive tools, farmers are empowered to forecast cultivation periods and address weather-related obstacles. It is crucial for the government to play a role in raising awareness and facilitating access to technology. Additionally, investing in post-harvest infrastructure and offering subsidies for technologies like drip irrigation can expand the areas suitable for cultivation and enhance yields. Collaborative initiatives, such as farmers’ collectives, have the potential to drive transformative change and bolster food security (Singh, D., Biswal, A. K., Samanta, D., Singh, V., Kadry, S., Khan, A., & Nam, Y. (2023).

The increase in tomato prices highlights the complex nature of the agricultural industry and the wider implications of fluctuating food prices. By acknowledging the various factors contributing to this issue, the government’s proactive approach, such as the Tomato Grand Challenge, demonstrates its dedication to finding comprehensive solutions. This forwardthinking strategy aims to improve tomato production, processing, and storage, reducing losses and adding value to the supply chain (P. (2023, June 28).

Advancements in areas such as better tomato varieties, the dissemination of crop planning information, and improved storage technologies are in line with the objective of stabilizing prices. The changing climate patterns and market dynamics require innovative strategies that incorporate predictive tools and informed cultivation practices.

Efforts by state governments further emphasize the potential of localized interventions in mitigating price surges. The ongoing surge in tomato prices serves as a catalyst for a holistic approach that involves strategic government intervention, technological innovation, and community participation. By aligning these elements, India can navigate the complexities of the tomato market, minimize price fluctuations, and ensure that all segments of society have access to this essential vegetable. This collaborative effort demonstrates the resilience of India’s agricultural sector in the face of challenges (FNB News. (n.d.)).

#### Causes South Asia refugee crises, mass radicalization, and megacity collapse.

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Climate change and extreme weather events are disrupting social and ecological systems throughout Pakistan, amplifying the risk of conflict and/or displacement by driving resource competition, exacerbating inequities in access and distribution, and directly impacting livelihoods and food security. These trajectories interact with pre-existing economic, social, and environmental insecurities to drive new or reignite pre-existing tensions. At household level, when in situ adaptation fails, out-migration increases in likelihood. At the local level, rural communities that rely heavily on agriculture and related livelihoods are especially vulnerable, as changes in resource availability, access, and usage heighten human security challenges. At the national level, inter-provincial competition over resources, exacerbated by climate-related resource scarcity, fuels ethnic divisions. Political tensions between provincial administrations over water distribution and hydropower development— such as the Kalabagh and Diamer Bhasha Dams—extend to community-level conflicts. These inter-provincial tensions are driven by power imbalances between upstream and downstream provinces, unequal distribution of risks and benefits, socio-economic disparities, and historical grievances (Mustafa et al. 2017). At community level, water can become a tool of conflict rather than a cause. It is often used as leverage in local political and ethnic struggles, particularly to rally agricultural communities against opponents in Punjab and Sindh, where access to clean water and irrigation water is a major point of contention (Ranjan 2012). Displacement can result when either local social-ecological systems fail to support livelihood generation, extreme weather forces households to flee for safety, or when increasing violence becomes too much to bear. Internationally, the fragile water-sharing agreement between Pakistan and India remains susceptible to geopolitical strains and climate-related pressures. The cascading impacts of climate change on Pakistan’s land and water systems are intensifying human security challenges and elevating the risk of conflict and/or displacement.

Rising temperatures, shifting rainfall patterns, and accelerated glacial melt are also straining Pakistan’s surface and groundwater resources. Climate change affects the water cycle through increased evaporation, altered monsoon patterns, rapid Himalayan glacier melt, and reduced groundwater recharge (Maqbool 2023). These changes heighten water stress, decrease storage capacity, and increase the variability of river flows (Maqbool 2023), leading to more frequent flooding (Babur et al. 2016). Groundwater depletion, driven by overextraction, shifting cropping patterns, and reduced recharge, disproportionately affects rural and urban populations reliant on this resource (Mujtaba et al. 2022). For example, surface water availability during the kharif season declined from 7.75 billion cubic meters (Bm³) in 2013 to 4.81 Bm³ in 2018, with similar trends during the rabi season (Mujtaba et al. 2022). This scarcity increases agricultural water demand, leading to resource competition and inequities in access. Groundwater depletion significantly affects the access and distribution of water for more than 70% of urban and 97% of rural populations, who rely on it for household needs and livelihoods (Mujtaba et al. 2022). In Balochistan, the karez system—a community based system of groundwater extraction for agricultural irrigation—has sustained communities for thousands of years but is now under threat from increasing over-extraction. These climate-related pressures pose a direct threat to traditional ways of life and, thus, social cohesion.

Rising temperatures and changing precipitation patterns are disrupting biodiversity, particularly in the northern mountains and marine ecosystems, accelerated by human activities. In the north, accelerated glacial melt threatens native species, while invasive species that prey on crops, such as wild boar in Khyber Pakhtunkhwa, thrive (Khan, Gul, and Khan 2015). Overgrazing and deforestation further degrade these ecosystems, undermining agriculture and livelihoods (Khan, Gul, and Khan 2015). This increases the likelihood of displacement in peaceful areas, such as in Gilgit-Baltistan, and conflict-prone areas, like Khyber Pakhtunkhwa and Balochistan, where livelihood insecurity exacerbates existing vulnerabilities or creates new ones, driving people to leave their homes. In marine environments, coral bleaching and changing currents jeopardize fisheries, posing risks to coastal communities dependent on these resources (Haider Ali and Hussain 2023). Due to Karachi’s proximity to fishing communities, it is a common destination for rural-urban migrants, whose arrival can amplify tensions over resources (land and water) and economic opportunities, in a dense city already burdened by generalized crime, poor public services and infrastructure, ethnically-drive politics, and sectarianism.

Climate-related disruptions to water and land systems threaten Pakistan’s agricultural productivity, food security, and rural livelihoods. Poverty, food insecurity and landlessness has been linked with increased likelihood of violent conflict in Pakistan (Malik 2011). Key crops, such based system of groundwater extraction for agricultural irrigation—has sustained communities for thousands of years but is now under threat from increasing over-extraction. These climate-related pressures pose a direct threat to traditional ways of life and, thus, social cohesion. Rising temperatures and changing precipitation patterns are disrupting biodiversity, particularly in the northern mountains and marine ecosystems, accelerated by human activities. In the north, accelerated glacial melt threatens native species, while invasive species that prey on crops, such as wild boar in Khyber Pakhtunkhwa, thrive (Khan, Gul, and Khan 2015). Overgrazing and deforestation further degrade these ecosystems, undermining agriculture and livelihoods (Khan, Gul, and Khan 2015). This increases the likelihood of displacement in peaceful areas, such as in Gilgit-Baltistan, and conflict-prone areas, like Khyber Pakhtunkhwa and Balochistan, where livelihood insecurity exacerbates existing vulnerabilities or creates new ones, driving people to leave their homes. In marine environments, coral bleaching and changing currents jeopardize fisheries, posing risks to coastal communities dependent on these resources (Haider Ali and Hussain 2023). Due to Karachi’s proximity to fishing communities, it is a common destination for rural-urban migrants, whose arrival can amplify tensions over resources (land and water) and economic opportunities, in a dense city already burdened by generalized crime, poor public services and infrastructure, ethnically-drive politics, and sectarianism. as wheat, rice, maize, cotton, and sugarcane, are facing yield declines due to rising temperatures, floods, and droughts (Nadeem, Jacobs, and Cordell 2022). For example, higher temperatures have negatively impacted wheat, while erratic rainfall disrupts rice and maize growth (Syed et al. 2022). The decline in wheat yield and basmati rice production is expected to worsen food insecurity and malnutrition, especially in rural areas (Syed et al. 2022). In livestock, heatwaves and water scarcity have reduced milk production by 20–30%, affecting farmer incomes (Q. Abbas et al. 2019). These challenges are particularly acute in regions like western Sindh and Balochistan, where agricultural output is heavily dependent on groundwater (Q. Abbas et al. 2019). Declining productivity exacerbates rural poverty and malnutrition, leaving communities more vulnerable to socioeconomic instability. Areas with high levels of deprivation, such as Swat, North Waziristan, and Dera Bugti—where food insecurity is particularly acute—are also among Pakistan’s most conflict-affected regions (Malik 2011).

Urban centers including Islamabad, Karachi, Lahore, Peshawar, and Rawalpindi face increasing risks from urban flooding, heavy downpours, heatwaves, droughts, storm surges, and flash floods (Atta-Ur-Rahman and Shaw 2015). These climate hazards exacerbate the pressure on an already depleted and scarce land and water resources, and on the limited capacity of the administration to provide adequate infrastructure or basic services such as electricity, water, and waste disposal. These hazards further exacerbate health risks, such as the spread of diseases and air pollution (Babar et al. 2021). Rising food prices due to reduced agricultural productivity further increase urban inflation, disproportionately affecting vulnerable populations (Bandara and Cai 2014). Poor urban planning has led to the proliferation of densely populated, disadvantaged, low- income settlements such as Ibrahim Hyderi, Lath Basti, and Rehri Goth in Karachi. Migrants, sometimes already displaced from other areas, tend to settle, but often face additional environmental hazards that increase the threat of being displaced once again (ICRC 2020). Large, insecure urban areas like Karachi are susceptible to ethnic politics and sectarianism, with rural-to-urban migration potentially exacerbating existing crime, terrorism, and generalized insecurity (Ahmed 2018).

Climate change and extreme weather events increase the scarcity of the natural resources necessary for livelihood generation. This includes the water, land, and forests essential for agricultural production (crops, livestock, fishing) and linked value chain actors, as well as manufacturing, food processing, and textile production. This in turn, can increase the likelihood of intra- and inter-communal conflict in areas dependent on these vulnerable livelihoods. For example, water shortages in Khyber Pakhtunkhwa’s Karak district have led to violence (Rasool, Saeed, and Shah 2020). In Khyber Pakhtunkhwa’s Newly Merged Districts (NMDs) landlessness, food insecurity, and poor resource access contributes to the growth of militant groups, such as Tehrik-e-Taliban Pakistan (TTP), who exploit these grievances to mobilize support from marginalized communities (Saad, Mahsud, and Mian 2024). In the wake of the 2010 and the 2022 floods, terrorist organizations such as TTP, Jamaatud-Dawah (JuD), Lashkar-e-Taiba (LeT), and the Baloch Liberation Army (BLA) increased relief and aid operations in KP and Balochistan, garnering local sympathy and bolstering their recruitment efforts (Saad, Mahsud, and Mian 2024). Additionally, the potential for civil unrest and social discord is exacerbated by district, provincial, and federal governments that struggle to provide basic services, economic opportunity, or fully address social grievances.

Furthermore, elites often capture resources through corruption, favoritism, nepotism, and bribery, leaving marginalized communities without access to agricultural land, water, and productive infrastructure (B. Aslam, Akhtar, and Nasim 2022). Water scarcity has heightened inter-provincial political tensions, with the Government of Sindh accusing the Government of Punjab of overusing Indus River water for irrigation and hydroelectric projects, exacerbating ecological concerns and political instability (Imran 2021). At the regional level, India and Pakistan’s water cooperation under the Indus Waters Treaty is strained by climate change and contested hydroelectric projects, heightening the risk of an international dispute (Zahoor 2024).

Pathway 2:

CLIMATE AND CONFLICT-RELATED MOBILITY LEADING TO HUMAN SECURITY RISKS IN ORIGIN AND DESTINATION AREAS

Displacement and forced immobility stemming extreme climate hazards and/or pre-existing conflict present significant challenges to human security, increasing the risk of additional forced migration and/or conflict—if poorly managed. Climate-related migration disrupts the human security of affected populations, particularly through its impact on livelihoods, entrenchment of poverty, and the state’s inability to provide adequate aid and basic services (Barnett and Adger 2007). These migration patterns interact with preexisting tensions and introduce new pressures on resources, economic conditions, and livelihood opportunities in destination areas, amplifying the risk of conflict. Factors such as resource depletion, overpopulation, economic competition, and disputes over land and water use in urban centers; such as Karachi, Lahore, Islamabad, have been identified as significant drivers of conflicts linked to climate-related mobility in Pakistan (F. Ali et al. 2018). In 2010, many flood-affected households migrated to Mohajir areas in Karachi, including Sindhi households from interior Sindh and Pashtun households from Khyber Pakhtunkhwa. These shifting demographics triggered resentment among Muhajir communities due to increased competition over land, water resources, and economic opportunities, leading to a notable intensification of ethnic conflict in the city (Makki et al. 2020; Crisp, Morris, and Refstie 2012).

Between 2008 and 2023, 25.5 million people were displaced by climate events, with 95% of these displacements resulting from floods. In some cases, the increasing frequency and severity of climate-related disasters have led to repeated displacements (H. B. Waseem and Rana 2023). Some return to areas of origin, despite the likelihood of recurring climate hazards, particularly flooding (Salik et al. 2020). Reasons for return include the psychological connection one’s home, formal land ownership or informal rental agreements, social ties, and limited financial resources (Salik et al. 2020). Pakistan now faces increasingly severe annual flood events. When combined with pre-existing poor socioeconomic conditions, elite exploitation, and the state’s inability to efficiently disburse aid, these events exacerbate grievances among affected populations, creating tension not only with the state but also with local elites and along ethnic lines. For example, following the 2010 floods, inequitable distribution of relief and recovery resources aggravated historical tensions between landowners and tenant farmers (Arai 2012). In Sindh, landlord-tenant relations, already fraught, deteriorated further as landlords controlled aid distribution, using it to assert social control (Arai 2012). Repeated extreme events continue to strain the state’s capacity to deliver aid and address the basic needs of affected populations, including shelter, sanitation, and livelihood support. Since the devastating floods of 2022, the state and international community have struggled to mobilize resources matching the country’s needs (Frege et al. 2023). International aid pledged remains only partially disbursed, highlighting gaps in financial and institutional capacity (Frege et al. 2023). As vulnerabilities increase across physical, infrastructural, social, economic, and institutional domains, the risks to human security intensify (H. B. Waseem and Rana 2023).

Climate disasters also drive migration by disrupting food security, reducing food availability, and driving up prices (H. B. Waseem and Rana 2023). This creates food crises, particularly in riverine areas, where food becomes scarce and unaffordable (H. B. Waseem and Rana 2023). Rural households, reliant on ecological systems for livelihoods, are particularly vulnerable. For example, riverbank erosion in Punjab and Sindh displaces landless communities, compelling them to migrate in search of economic opportunities (D. Anmad and Afzal 2021). Food insecurity is closely linked to migration, as households with limited or no farming land and few employment opportunities face increased pressures to relocate.

In Pakistan, many rural residents move toward cities seeking safety from violent conflict, improved livelihood opportunities, and access to services (D. Ahmad and Afzal 2021; Salik et al. 2020; Crisp, Morris, and Refstie 2012). More than 5 million Pakistanis were displaced by conflict (often terrorism or counter-terrorism operations) between 2008 and 2023, (IDMC 2023a). Urban areas—frequent destinations for those who are displaced from and agentically migrate from rural areas—may experience heightened human security risks if service delivery is not scaled to match increasing demand. For example, the arrival of Pashtuns in Karachi, fleeing violence in Khyber Pakhtunkhwa and Baluchistan, has triggered political resistance from Sindhi and Mohajir political constituencies due to perceived changes in the ethnic composition of host communities and competition for jobs and services (Makki et al. 2020; Crisp, Morris, and Refstie 2012). In diverse cities such as Karachi, ethno-political parties strategically exploit grievances, fueling sectarianism. Historical and ongoing displacement patterns, shaped by ethnic dynamics, significantly influence the trajectory of conflicts in Pakistan.

Not all households can successfully adapt in place amidst declining environmental conditions and may become immobile either by choice or necessity. Rural households that depend on agricultural production often lack the financial means or social capital to successfully adapt. While poverty is the most common driver of vulnerability, demographic marginalization can further restrict adaptive capacity; this is true for women, who face gender-based marginalization, the Hazara Shia community, who are persecuted for their religion, and Afghan refugees, who lack access to formal services and face the risk of deportation due to their nationality. Vulnerable households may become “trapped” in deteriorating social or ecological conditions or forced to return to insecure geographies after suffering a displacement event. It is often socially unacceptable for women to move without male family members, who themselves often migrate outward, sometimes seeking work after disasters like floods or droughts (Abbasi, Naeem, and Ansari 2021). This can trap women in precarious conditions. Afghan refugees, who have traditionally used crossborder and domestic movements, resource networks, and circular migration to cope with displacement, also face diminished mobility options due to heightened politicization over the past two decades (Mielke and Etzold 2022)

Pathway 3:

CLIMATE HAZARDS AND CLIMATE-RELATED DISPLACEMENT INFLAMING PRE-EXISTING CONFLICTS

In some cases, pre-existing conflicts can be exacerbated by the impacts of climate change and mobility flows. Climate change and variability can amplify the likelihood of displacement, particularly in protracted conflict areas characterized by deuterated human development, entrenched poverty, and political marginalization. Climate hazards may make it harder for households to shelter in place, rendering migration a more viable adaptation strategy than remaining in place. The negative effects of conflict and climate hazards may also compound to depress livelihood generation, pushing households to engage in economic migration. Ongoing conflicts can limit the ability of local and national governments to support climate adaptation efforts, equitably manage natural resources, respond to community conflicts, or support mobile populations through service or infrastructure provision. As a result, conflict zones provide fertile ground for extremist groups to address the unmet needs of local populations and exploit anti-state frustrations for violent or criminal activities. Consequently, even in post-conflict situations where tensions are present, but violence has subsided, climate hazards or large population movements may trigger its re-emergence, undermining stability, and resilience. Moderateto-severe drought conditions in southwestern Balochistan (Chagai, Noshki, Kharan, and Washuk district) during the summer months, paired with extreme cold and snow events in winter months, exacerbates environmental, food, economic, and health insecurities. This can, in turn, displace household to neighboring districts in Balochistan already grappling with terrorism and insurgencyfueled instability (Moin 2023). In destination areas, declining human security may lower the perceived opportunity costs for joining extremist groups, increasing the likelihood of violence. Similarly, following the 2010 floods, in central and southern Punjab, pre-existing religious extremism, ethnic violence, and crime increased as Jamaat-ud-Dawah (JuD) and Lashkar-i-Tayyeba (LeT) from Punjab recruited small riparian farmers whose land was damaged by flood waters (Saad, Mahsud, and Mian 2024).

#### Large-N studies confirm the link between food and radicalism.

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Anecdotal evidence suggests a strong tie between food security and terrorism. Indeed, the inception of several prominent terrorist organisations can trace their roots back to food security issues. The Shining Path’s emergence in Peru, for example, can be traced to subsistence issues in the country’s highland areas, which created an opportunity for the organisation to recruit potential supporters. McClintock suggests (1984: 59) ‘People in the southern highlands earn little, die young, are mostly illiterate, and usually exist without basic human services.’ The core nature of grievances and the inability of governments to address these concerns enabled the Shining Path to garner support among peasants in the region. These grievances were exploited early on, as the Shining Path originally projected itself as a moral corrective to the state, forming support bases far from urban centres that supplied resources, including food, to the rural populace (Stiefer 2017). This case does not appear to be an outlier as emerging terrorist groups seize on a food insecure public, using money and food as incentives for joining. For example, one of the key tactics of the Islamic State when they move into an area with scarce resources is to capture access to all economic and social infrastructures, which they then use as leverage to increase their ranks. Interviews with defectors from the Islamic State point to the fact that many join the terrorist group out of desperation and hunger. ‘When Daesh took over they said, “You are either with us or not.” They gave no food, no jobs except to people who joined them, so the people got hungry’ (Speckhard and Yayla 2015: 99). A similar rationale drives recruitment to Al-Shabaab, with one member explaining that he and his friends were lured with promises of a mobile phone and $50 a month upon joining (Botha and Abdile 2014: 5). Indeed, many recruits to Boko Haram viewed membership as an economic step forward (Mercy Corps 2016).

These examples provide tentative insight into the fundamental role of food insecurity in increasing terrorist activities and prompt us to ask whether this is part of a larger pattern. Does food insecurity promote a rise in terrorist violence? Research on the relationship between food security and conflict is well documented in revolutionary Europe and Russia (Rudé 1964; Tilly 1971), the ‘IMF riots’ of the 1970s and 1980s (Walton and Seddon 1994), and most recently the food price peaks of the 2000s (Weinberg and Bakker 2015; Hendrix and Haggard 2015). However, evidence of its effects on terrorism is lacking (Adelaja et al. 2019). We address this lacuna in the literature.

Drawing on Amartya Sen’s (1999) work on development, we propose that food security plays an important role in enhancing human capability. We argue that the absence of adequate food is likely to increase grievances among citizens and may lead the populace to question the ability and the legitimacy of the government to provide for them. Furthermore, prevalence of grievances presents an opportunity for terrorist organisations to mobilise potential supporters to join their cause. This is especially likely among developing countries where materialistic issues that ensure physical and economic security (such as food security) play an important role (Inglehart 1977, 1997).

We assess the effect of food insecurity on domestic terrorism among 70 developing countries from 1980 to 2011, and our findings provide support to the hypothesised relationship between the two. This article makes two primary contributions to the existing literature. First, the article presents a theoretical perspective linking food security to domestic terrorism among developing countries. Second, the findings provide specific policy implications for countries facing terrorism. By demonstrating the significance of food security in reducing terrorism, we hope to provide better insight to leaders and organisations that are dealing with the challenges associated with terrorism.

More generally, this article speaks to the larger body of research on development and conflict. Food security is a core aspect of development (Sen 1999), and as such food security, poverty, and economic development are closely interlinked and cannot be separated (Tweeten 1997). This research also contributes to broader works on food insecurity and political unrest (Weinberg and Bakker 2015; Pinstrup-Andersen and Shimokawa 2008; Hendrix and Brinkman 2013; Hendrix and Haggard 2015) by focusing on the effect of food insecurity on a specific facet of political violence, namely domestic terrorism.

The article is organised in four sections. In the following section, we clarify the concepts of food security and terrorism and elaborate on our operationalisation of food security with protein supply per capita. We elaborate on how our theoretical conceptualisation and measure of food security captures one of its core pillars, food availability. The next section draws the theoretical link between food insecurity and domestic terrorism. We then discuss the data and methodology to assess the relationship between the two, followed by our empirical findings. The last section discusses the policy implications and avenues for future research.

Food Security and Terrorism: Defining the Concepts

We view food security as an important aspect of development, which is a multidimensional process and goes beyond traditional measures such as income. For instance, the Human Development Index includes other factors in its conceptualisation of development as well such as life expectancy and education levels. Sen (1999: 38) takes a broader approach and emphasises five types of development or freedoms that include political freedom as well as social protections that ensure education, health, and prevent hunger, among others. We specifically focus on one fundamental aspect of development, food security.

Commitment of organisations such as the Food and Agriculture Organization (FAO) of the United Nations and the United Nations Development Program (UNDP) to ensure global food security highlight the importance of the issue. The World Food Summit (WFS) organised in Rome in 1996 as well as the First Millennium Development Goal established in 2000 aimed at reducing the number of undernourished and hungry by half by the year 2015. However, while considerable progress has been made, ‘hunger remains an everyday challenge for almost 795 million people worldwide, including 780 million in the developing world’ (FAO 2015: 4). This is reflected in the 2030 Agenda for Sustainable Development as well that has ‘Zero Hunger’ as one of the 17 Sustainable Development Goals (SDGs) (UNGA 2015).

The concept of food security has evolved over time to incorporate food availability as well as access, utilisation, and stability (FAO 2006). We adopt the FAO’s (2006) conception of food security, which refers to presence of food security ‘when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life’. In particular, the definition incorporates four pillars or dimensions of food security: food availability, access, utilisation, and stability, which relate to availability of quality food, existence of adequate resources to acquire food, utilising quality food to reach nutritional well-being, and ensuring availability and access to adequate food at all times to ensure food security, respectively.1 This conception of food security emphasises three attributes (Pritchard 2016: 2). First, food security is achieved when it meets the needs of the people. Second, the definition is ambitious as it seeks to include ‘all people’ in the global community. Third, the quality of food is important as the concept also refers to ‘safe and nutritious food’. The academic literature has not always identified which aspect of food insecurity affects societal peace adversely (Rudolfsen 2018). This is beginning to change. For instance, Adelaja et al. (2019) differentiate between dimensions of food insecurity and its consequences for societal peace. We adopt a similar approach by linking food availability to domestic terrorism.

Our theoretical explanation that links food insecurity and domestic terrorism focuses primarily on the most fundamental aspect of food security: availability of quality food. Food availability includes domestic production, imports, as well as food aid. We measure food security with protein supply per capita (FAO 2016), which closely relates to food availability (Lele et. al. 2016). Scanlan and Jenkins (2001) use a similar measure to capture food security, specifically food availability as well as access. Even though we focus primarily on food availability, we draw on Scanlan and Jenkins’ argument (ibid.: 160) that food availability also captures access to the ‘global bread basket’. As such, we contend that the two are likely to be correlated so that absence of food availability may also reduce food access to an extent.2

Our measure of protein supply is an appropriate measure of food insecurity for this article as lack of adequate food supply captures core grievances and primarily affects the poor for two reasons (Blaydes and Kayser 2011). First, adequate food intake remains a primary concern for the poor who are also more likely to spend any increases in their income on food as compared to the rich. Second, food is also relatively difficult to hoard, as it is perishable. Since there are limits to how much food one can consume, any prominent changes in food consumption may be indicative of changes on the national scale. Our theoretical explanation linking food insecurity to domestic terrorism focuses primarily on core grievances, which are likely to be most prevalent among the poor. Adequate food consumption is especially a concern in the developing world, making this measure appropriate given the sample under study.3

Food security has commanded the attention of the academic community since Maslow (1943) offered his theory about human motivation being related to food security. Maslow’s hierarchy of basic human needs identifies physiological needs at the bottom of the pyramid followed by safety, love, esteem, and lastly self-actualisation needs. We place food security as a physiological human need in Maslow’s hierarchy. The supreme importance of food is underscored by Maslow, who states, ‘For the man who is extremely and dangerously hungry, no other interests exist but food. He dreams food, he remembers food, he thinks about food, he emotes only about food, he perceives only food and he wants only food’ (Maslow 1943: 374).

Food security is perceived as a primary end as it relates to one of the most basic physical capabilities of individuals. Without adequate food, individuals can be deprived of the ability to pursue a better quality of life that includes improved health, access to educational opportunities, economic self-sufficiency, contributing to the economy in meaningful ways, and advancement of the self as well as the society as a whole. Maslow echoes this sentiment as he states, ‘A person who is lacking food, safety, love, and esteem would most probably hunger for food more strongly than anything else’ (ibid.: 373).

Amartya Sen, one of the prominent developmental scholars, also emphasises the significance of food security for individual capability and development and views development as ‘a process of expanding the real freedoms that people enjoy’ (Sen 1999: 36). In recent empirical research, several studies focus on the causes or consequences of food security (Scanlan and Jenkins 2001; Hendrix and Brinkman 2013; Hendrix and Haggard 2015; Adelaja et al. 2019, among many others). We contend that Sen’s (1999) reference to food security and Maslow’s (1943) emphasis on physiological needs place food availability as an underlying need for survival. 4

We see political leaders addressing food shortages domestically as well as demonstrated by the Chinese Communist Party (CCP) in China where the party initiated rural reform policies between 1949 to 1956 to address lack of adequate food and recognised its significance in bringing about development more generally (Shue 1980: 22). This approach is consistent with Sen’s emphasis on adopting a broad approach to addressing hunger, which includes addressing the causes of poverty and enhancing better access to food through a variety of policies (FAO 2013).

Turning next to terrorism, we define it as an act that involves the premeditated use or threat of violence by subnational groups or individuals for the purpose of obtaining a political, religious, or social objective by intimidating a large audience beyond that of the immediate victim (Enders and Sandler 2006: 3). This definition captures the key elements of terrorism in that every attack involves a victim, a perpetrator, and an audience. Victims are generally assumed to be civilians and non-combatants, though non-combatants can sometimes include both civilian police and military assets outside of war zones (US National Counterterrorism Center 2007). Perpetrators of terrorist violence can involve any variety of groups, individuals and states (Clutterbuck 1994; Hoffman 2006), though it is assumed to be utilised primarily by non-state actors. Finally, and crucially, every attack involves an audience beyond the immediate victim. There are multiple groups that are signalled by an attack, but attacks serve primarily two audiences ‒ sympathisers of the victim, who are meant to be intimidated by the terrorist act, and sympathisers of the perpetrator, who serve as potential recruits for future terrorist attacks (Rosendorff and Sandler 2004; Schmid 2005). For the purposes of this study, we are equating terrorism exclusively with instances of actual terrorist violence, though we recognise that many countries also criminalise actions that enable violence, such as financing, planning, and recruitment efforts (US Department of State 2011).

Figure 1 displays the number of domestic terrorist attacks within OECD and non-OECD countries from 1980 to 2011. Domestic terrorism is a terrorist incident in which the nationalities of the victim and perpetrator are the same as the venue of the state in which the attack occurred. Both groups of countries have been witnessing acts of domestic terrorism in recent years. However, it is a much more frequent phenomenon in the developing world as compared to the developed world and this warrants a closer look.

Food Security, Development, and Terrorism: A Review of the Literature

The relationship between food insecurity and political violence is nuanced, involving a circular link in which food insecurity can act simultaneously as a source of grievance in certain cases while mitigating instances of conflict in others (Flowers 2016). Research on the relationship between food insecurity and conflict has examined various types of conflict, including civil war, intrastate communal conflict, urban unrest, and, more recently, terrorism. And while the causal chain is often not attributed to a single variable, there is convergence in the literature in associating the key elements with some forms of political violence, including the effects of food and fuel prices, droughts, and their interaction with state institutional characteristics.5

Despite the large body of work examining the links between food security and conflict, few contemporary studies have directly examined its relationship with terrorism. Those that have generally find that food insecurity, specifically lack of food access, increases grievances among individuals, which terrorist organisations exploit for recruitment purposes either by providing resources that the state cannot (Adelaja et al. 2019), or that food price volatility and food price increases enable terrorist organisations to serve as agents of collective action and increase terrorist violence (Piazza 2013).

We specifically focus on the impact of food availability on domestic terrorism. Due to the fundamental necessity of food to an individual’s wellbeing (Maslow 1943), we can situate the discussion of food insecurity within the ‘root causes’ literature on terrorism. The ‘root causes’ of terrorism hint at some causal relationship between underlying social, economic, political, and demographic elements and terrorist activity (Newman 2006: 749). The scholarly debate over the root causes of terrorism, particularly concerning the effects of state economic conditions, is a well-worn path fraught with contradiction. The ‘economic inequality-political conflict puzzle’ (Lichbach 1989) captures the sentiment of scholarly research by stating that many assume a relationship exists, but there is a lack of consensus on the nature of the dynamic. The empirical literature on this debate diverges into two strands of research — the ‘relative deprivation’ thesis (Gurr 1970), which examines the capacity for political violence, and the ‘political opportunity’ thesis, which examines the circumstances favourable to political violence (Tilly 1978).

Regarding relative deprivation, it is important to realise that objective poverty is not sufficient to induce terrorism (Crenshaw 1981). Instead, the focus is on the relativity aspect ‒ that is, the difference between the standards that a group perceives they ‘ought’ to be living by and the standards that they actually are living by. When this perceived imbalance ratio grows to a certain threshold, political violence is more likely (Huntington 1968; Piazza 2006).

Applying this logic to terrorism, Piazza (2011) finds states featuring economic policies that benefit certain subsets of their population over others can cause aggrieved minority groups to turn to terrorism. Similarly, Callaway and Harrelson-Stephens (2006: 685) find a nonlinear relationship between subsistence rights and terrorism in Northern Ireland. Subsistence levels that sit between the extreme ends of low and high represent emerging middle classes whose expectations have risen faster than their economic well being ‒ the Red Brigade and Baader-Meinhof are exemplary of this theory, as their members tended to be working or middle-class students and intellectuals (Combs 2003).

Regarding the opportunity thesis, state contextualisation of political events and institutional structures are the main facilitators of violence. The institutional environment within democracies, for example, provides ample opportunity for terrorist attacks (Enders and Sandler 2006). The protections offered to citizens by democracies, such as freedom of speech, association, and civil and political rights, are the same qualities that protect terrorists and facilitate their operation, providing them with the opportunity to attack, an argument that has found both support (Eubank and Weinberg 2001; Savun and Phillips 2009) and refutation (Eyerman 1998; Abrahms 2007). Additionally, the ability of state institutions to insulate their populations from economic shocks is crucial. Blomberg et al. (2007) find that stronger institutions provide incentive for groups to use terrorism to change the status quo, since it is unlikely that a full rebellion would topple the state.

In light of the evidence, it is implied that social welfare and other policies designed to remedy poverty and mend sociodemographic divides may have direct and indirect impacts on terrorism as well. Burgoon (2006) and Krieger and Meierrieks (2010) take this logical next step and find that welfare indeed works to reduce the frequency of terrorist incidents, however the exact process by which this is achieved is unclear. Welfare can be theorised to affect terrorism in a number of ways. Welfare transfers are found to alleviate the economic inequality-political conflict puzzle by reducing relative deprivation and discontent that lead to civil and ethnic conflict (Gurr 1970; Auvinen and Nafziger 1999; Fearon and Laitin 2003). Additionally, welfare can reduce religiously inspired terrorist acts. In the absence of state infrastructure, fundamental religious organisations often step into the vacuum to provide social services (Townsend 1994; Landau 1993; Gruber 2003). Indeed, Piazza (2011) states that the existence of terrorist organisations helps aggrieved populations overcome barriers to collective action, resulting in terrorist attacks. The Islamic State, for example, offers refugees food and cash up to $1000 (Steinbuch 2017), and Boko Haram provides meals and loans to prospective recruits, among other goods (Meagher 2014). 6 These examples are indicative of rising contemporary terrorist groups’ desires to compete with states (Rosen 2015; Piesse 2017). Such actions can lead to the deepening of religious belief and participation, potentially increasing the probability of religious-extremist motivated violence that could be reduced with the introduction of state-run welfare infrastructure as a substitute (Burgoon 2006). Religion can also serve as an explanation, a rallying point for identity, or a source of empowerment to some who are disoriented from sweeping socio-economic change. In the face of overwhelming population growth and urbanto-rural migration, Pakistan, for example, has seen a number of its poor becoming susceptible to the appeals of extremist groups who provide explanations for the state’s failure to address the grievances of the poor (Khan and Azam 2008: 73).

However plausible these arguments are, they have yet to be explored directly. Indeed, some argue that the roots of terrorist violence are more in the political and social realm than the economic (Krueger and Maleckova 2004; Piazza 2006). Furthermore, even if there is an economic aspect to terrorism, it is not conclusively shown that welfare is a mechanism of alleviation. Welfare and other social policies, especially when employed in developing states, can be targeted at elites and specific ethnic groups, exacerbating horizontal inequality (Stewart 2000; Piazza 2011). Thus, it is important to understand which components of welfare are the most influential.

Much as the concept of democracy is comprised of multiple institutional and cultural elements, the concept of welfare is an amalgamation of various policies, each with possible cultural overtones. It could be that some welfare policies work at cross-purposes, both engendering and hampering terrorism, as has been found when deconstructing democracy in such a manner (Li 2005). Overall, the studies on welfare spending and terrorism (Burgoon 2006; Krieger and Meierrieks 2010) demonstrate that greater welfare spending is associated with fewer instances of terrorism plausibly because a government that spends more on welfare to address the socioeconomic grievances of its populace is more likely to maintain peace within the country. The notion of welfare is a relatively broad concept with theoretically plausible contradictory effects. We hope that our focus on food availability, on the other hand, will provide us with a deeper understanding of the nature of grievances that motivate individuals to resort to terrorist activities.

Food Security and Terrorism: A Theoretical Link

We argue that food insecurity creates grievances among citizens and increases demand among them for action against the government. Terrorist organisations provide the opportunity for citizens to channel their grievances against the government by resolving collective action problems and mobilising citizens. We elaborate on the link between the two in this section.

Governments are generally considered responsible for ensuring provision of basic necessities such as public health and education (Baum and Lake 2003) and they have a variety of tools at their disposal to enhance societal wellbeing. Citizens may look to their governments for ensuring that the people have adequate food because the lack of it leaves few, if any, opportunities for people to prosper. It creates a sense of deprivation and is indicative of serious grievances among the populace. The lack of essential provisions hurts public perception about the government (Bueno de Mesquita et al. 2003; Taydas and Peksen 2012) and may suggest that the government is either unable or lacks the motivation to provide for its citizens. This especially applies to food insecurity where the inability of the government to ensure adequate food availability may lead citizens to question the government’s legitimacy and capacity to deliver essential provisions to the masses. Similarly, the lack of motivation on the part of government to ensure food availability may be indicative of governmental priorities to an extent. This could be suggestive of neglect for societal needs, which arguably should be a priority for governments over other domestic and foreign policy goals. Both scenarios, the inability or the lack of incentive on the part of government to ensure food security of the populace, increase the demand among citizens to resort to violent tactics such as terrorism. Emphasising the role of physiological needs in motivating human action, Maslow states, ‘All capacities are put into the service of hunger-satisfaction, and the organization of these capacities is almost entirely determined by the one purpose of satisfying hunger’ (Maslow 1943: 373). We argue that food security, and specifically, food availability, is a core physiological need and lack of it may provide the necessary motivation for citizens to join or sympathise with a terrorist organisation.

Much like rebel groups that use pecuniary awards (Gates 2002) and the promise of better performance than governments (Weinstein 2007) to recruit supporters, deprivations that hinder physical security of individuals such as food insecurity may be used as a recruiting tool by terrorist organisations as well to get people to rally behind their cause. These extremist organisations lower the opportunity costs of collective action by serving as a focal point for individual grievances. Furthermore, their appeal is heightened by the provision of goods and opportunities that extremist organisations provide but the state cannot. This is especially applicable to food availability, which is a core human need. Thus, lack of food availability can stimulate grievances that terrorist organisations exploit for their own purposes.7 The argument is backed by case evidence. Interviews with former al-Shabaab fighters in Somalia, the most-food insecure nation in the world, reveal that socio-economic conditions were the most common motivator for joining (Botha and Abdile 2014).8

The dynamic between food security and domestic terrorism is especially likely among developing countries where people have materialistic concerns that emphasise economic and physical security (Inglehart 1977, 1997).9 Developing countries are societies where essential needs such as food security still play an important role and are a primary consideration for individuals. It is in developing societies that the opportunity for terrorism arises due to the low bureaucratic and administrative capacity of the state (Hendrix and Young 2014). Low capacity on this dimension leads to a state’s inability to mitigate violence due to the lack of resources that enable it to respond to dissent and channel popular aggression. (McBride et al. 2011). In effect, a state with low administrative capacity cannot ‘see’ its population (Scott 1998). These problems are exacerbated by states that regularly violate human rights, as Callaway and Harrelson-Stephens (2006) find that repressive states that violate civil and political rights, in addition to an inability to provide basic needs to their populace, are more likely to experience terrorism. Hence, the ability of a state to absorb protests and incorporate individuals into the polity lowers the chances of people seeking redress outside of the system by violent means (Essman 1994).

Prevalence of food insecurity can be attributed to international factors as well as domestic shortcomings, reflected both in terms of a state’s colonial past as well as the power dynamics of the global system, in which developed countries drive inequality by structuring the international system to benefit themselves at the expense of the global poor (Callaway and Harrelson-Stephens 2006). 10 However, citizens hold primarily national governments responsible for lack of adequate public goods and services (Baum and Lake 2003). As a result, citizens are especially likely to direct their grievances against their national governments versus international actors. Moreover, we also rely on Gurr’s (1993) relative deprivation model and Crenshaw’s (1981) models of group grievance, which assumes political violence to be directed locally and motivated by local conditions involving local actors (Piazza 2011: 343).

Our theory rests on the logic of grievances that are exploited by terrorist groups who lower the opportunity costs of engaging in violence against the state by providing resources to the aggrieved population. It is important to note that our conceptualisation of terrorism stresses that it is a tactic of political violence that can be employed alongside other violent and non-violent strategies. 11 Thus, disentangling the specific causal mechanisms of terrorism from other forms of political violence at the state level is a particularly nebulous endeavour. Though our theory provides a causal process for terrorism, it is entirely possible that it can lead to other forms of political violence.

Burgoon (2006) identifies an alternative theoretical link where he discusses the plausibility that states with generous welfare policies may enhance capacity of individuals by providing access to greater resources and time and this in turn may increase terrorist violence.12 However, he eventually asserts that the benefits associated with greater welfare spending will deter terrorist activity. A robust welfare state may enhance food availability by ensuring food supply for citizens through adequate food production domestically, for instance.13 It is possible that food security may enhance capacity of individuals, which in turn could plausibly enable individuals physically to pursue terrorist violence in light of other grievances. However, food security only ensures physical capacity and may not enhance capacity in other aspects such as time and additional resources that come with greater welfare spending. Thus, the capacity enhancing effects of welfare spending in terms of having access to more resources and time is less likely to be prevalent in the case of food security. On balance, we argue that the relationship between food security and terrorism in the developing world can be better explained through the grievance mechanism than the capacity mechanism. Based on our theoretical expectations, we hypothesise that lower levels of food security will lead to higher levels of domestic terrorist attacks among developing countries.

Data and Methods

We assess the relationship between food security and domestic terrorism on a sample of 70 developing countries from 1980 to 2011.14 The unit of analysis is country-year. The dependent variable consists of a raw count of terrorist attacks within a country-year and are taken from the Global Terrorism Database (GTD), collected by the Center for the Study of Terrorism and Responses to Terrorism at the University of Maryland (START 2016). We choose it as our data source because its selection criteria fit with our previous conceptualisation of terrorism. It also includes additional filtering criteria that allow us to limit the data exclusively to acts carried out for the purposes of attaining a political, economic, religious or social goal that includes evidence of an intention to coerce or intimidate a larger audience. Additionally, we isolate the data to only include acts that were carried out outside the context of legitimate war activities. Ambiguous cases are excluded. We focus on instances of domestic terror only, as the outlined theory is meant to capture the preferences of civilians within a state where the government is either unable or unwilling to provide food security. Therefore, utilising filtering mechanisms within the GTD, we only examine acts in which the victim, terrorist perpetrator, and attack venue are of the same nationality. The list of non-OECD states in the sample is provided in Appendix B. 15

The primary independent variable is food security ‒ more specifically, we focus on food availability. We measure food security with protein supply in grams per day per capita, and the data come from the Food and Agriculture Organization (FAO 2016). FAO food balance sheets provide the most comprehensive yearly estimate of food consumption from a supply perspective and previous research uses similar measures to capture adequate food intake (Blaydes and Kayser 2011; Scanlan and Jenkins 2001).16 The variable relates closely to food availability (Lele et. al. 2016: 18), which is the primary focus in this article.17

The remaining variables represent a framework that attempts to capture the social and institutional factors that make the occurrence of domestic terrorism more likely. The regressions to follow largely replicate a model put forth by Qvortrup and Lijphart (2013) that intends to model the expected value of engaging in domestic terrorism against the expected value of not engaging in terrorism. The controls are intended to be representative of the standard framework of variables shown to have explanatory value in previous studies. From there, additional controls are included as further checks of robustness.

The first three variables capture institutional respect for human security. As noted in the theory, grievances over food security can be exacerbated by states, particularly regarding the degree of repression and respect for civil rights. To address this, a regime indicator (polity2) from the POLITY IV database variable is included to measure the level of democracy, as its inclusion is consistent with past studies examining the link between democracy and terrorism (Li 2005; Piazza 2008; Savun and Phillips 2009). It ranges from -10 (full autocracy) to 10 (full democracy). The characteristics of democracy, freedom of association and expression, the assurance of free and fair elections, and the rights of citizens to participate in the electoral process, are widely debated between two opposing viewpoints. The first viewpoint sees these characteristics as having an enabling, positive effect on terrorism, giving individuals the capacity to carry out attacks more freely than if conducted in a relatively more authoritarian system. Conversely, the opposing viewpoint frames these characteristics as a political release valve, allowing individuals an avenue to air grievances instead of resorting to violence. Considering the competing theories regarding the relationship, we conduct a two-tailed test.

The positive link between democracy and respect for human rights is well established (Henderson 1991; Poe et al. 1999), yet democracies are not incapable of using repressive coercion (Kibris 2011; Conrad et al. 2017). To capture ties to repression more properly, two additional measures are included. Executive constraints is included from the POLITY IV database to measure the ability of the legislature to check executive power, as unchecked executives are less likely to promote civil rights (Li 2005). This variable ranges from 1 (unlimited executive authority) to 7 (executive subordination). The data for both variables come from POLITY IV (Marshall et al. 2016).

The third variable is a more explicit measure of governmental repression. A measure of physical integrity is taken from the Cingranelli-Richards (CIRI) Human Rights Dataset (Cingranelli et al. 2014). This variable is an additive index of instances of torture, extrajudicial killing, political imprisonment, and disappearance. It ranges from 0 (no government respect for these rights) to 8 (full government respect for these rights). Previous research using CIRI data to explore the link between government oppression and terrorism found a complex and interconnected relationship (Piazza and Walsh 2009, 2010; Walsh and Piazza 2010). We make no directional assumption of causality here beyond including human rights abuses as a control.

To capture economic and sociodemographic characteristics, a logged measure of a state’s GDP per capita is included. This variable generates mixed effects in the literature (Testas 2004; Li 2005; Abadie 2006). Since our focus is on food security within developing countries, this measure is included as a robustness check to model the effect of the primary variable of interest independently of developmental characteristics. A measure of urban population is a percentage of a state’s population living in urban areas and is expected to have a positive effect on terrorism, as urbanisation’s trend towards aggregation and complexity increases the wealth and accessibility of targets for potential terrorists (Urdal 2006; Qvortrup and Lijphart 2013; Crenshaw 1981; Adelaja et al. 2019). We include a country’s total population as an additional measure of population constraints. We hypothesise that larger populations lead to an increase in domestic terrorism. The causal mechanisms behind this stem from a wider audience and target pool (Coggins 2015), though this variable can also capture the grievances that arise in a country with a significant gap between the supply and demand of public goods (Adelaja et al. 2019). The data for all three variables come from World Development Indicators (World Bank 2016).

Finally, a variable measuring the occurrence of civil war is included. It is a dummy variable with a 0 indicating no civil war and a 1 indicating its presence and the data are available from PRIO (Gleditsch et al. 2002). Terrorism is prominently used before, during, and after civil war in conflicts worldwide (Findley and Young 2012: 286). Thus, we expect a positive relationship between terrorism and the presence of civil war. A full summary report of descriptive statistics is presented in Appendix A. 18 The summary statistics for terrorist attacks display a conditional mean far lower than the variance, indicating overdispersion in the count variable. To control for this, we utilise a negative binomial regression model with fixed effects. To control for time dependence and address reverse causality to an extent, all independent variables are lagged one year. Across all models used, the alpha value differs significantly from 0, indicating that the negative binomial model is preferred over Poisson.

Results

Our primary hypothesis seeks to assess the effect of food security on domestic terrorism among non-OECD countries. Our main tests are presented in Table 1. Model 1 presents the baseline findings without the theoretical variable of interest and model 2 includes the variable of interest. The primary results in model 2 indicate that food security is statistically significant where higher levels of food security are associated with fewer domestic terrorist attacks. This provides support for our primary hypothesis. Food insecurity, particularly lack of food availability, is indicative of physical and economic insecurity among masses and may be a reflection of a government that is incapable or lacks the motivation to ensure basic provisions for its citizens. This is likely to increase grievances and create opportunities for terrorist groups to recruit potential supporters, consequently increasing the probability of domestic terrorism. The findings do not provide support to the alternative argument, which suggests that food security could enhance capacity of individuals, thus increasing terrorist attacks. Overall, the findings are consistent with our theoretical expectations about the effect of food security. Substantively, a one unit increase in protein supply decreases the rate of terrorism by 1.7%. When applying this to the data on protein supply within non-OECD countries, increasing protein supply by one standard deviation results in a 35.4% decrease in the rate of terrorism, holding all other variables constant, which is a substantial effect.

Regarding the control variables, greater executive constraints are associated with higher number of terrorist attacks. It is widely regarded that terrorism favours power vacuums best represented by failed or transitioning states (Atzili 2010; Fukuyama 2004). Greater executive constraints may present opportunities for terrorist activities, especially among developing countries. A higher level of democracy is associated with fewer terrorist attacks, although the variable is not significant.19 Total population is not significant in the majority of the models.

GDP per capita has the same effect across the majority of the models, where countries with higher levels of GDP are less likely to face attacks of domestic terrorism, plausibly because countries that are more developed are less likely to have grievances that may result in acts of domestic terrorism. However, it is only significant in the baseline model. The effect of physical integrity index, which measures human rights violations, is negatively associated with terrorism. Countries with better human rights relations are less likely to face domestic terrorist attacks, presumably because if governments are more respectful of citizens’ human rights, people are less likely to resort to violence. Urban population is significant where a higher percentage of population living in urban areas is likely to increase the number of terrorist attacks. Urban environments present favorable targets due to the potential for high fatalities and public attention that such attacks would garner (Crenshaw 1981; Jenkins 1978).

Lastly, civil war is positive and significant across most models. It also has a substantial effect ‒ countries in the midst of civil war experience more than twice the number of domestic terrorist attacks than countries at peace. This should come as no surprise, for though civil wars account for 25% of our observations, the mean of attack ratio during a civil war period compared to a peace year is almost 30 to 1, highlighting the close, interrelated dynamic between the two types of violence. Furthermore, every country in our sample has experienced civil conflict at some point. In addition to the fact that many groups employ terrorism alongside civil war (Findley and Young 2012), the presence of civil conflict can deplete state capacity, further disrupting food security and fomenting grievances among a dissatisfied populace, setting the state for additional terrorist violence (Gupta et al. 2007).

Primary findings in Table 1 include country-fixed effects to assess whether changes in food security within a country influence the number of terrorist attacks. Table 2 presents negative binomial coefficients without country-fixed effects and with year (model 1) and region dummies (model 2) to ensure that the primary findings are not being driven by a particular year or region.20 The effect of food security remains the same in models 1 and 2 where food security has a significant and negative effect on domestic terrorism.

Table 3 presents additional robustness tests with negative binomial coefficients. Model 1 includes a lagged dependent variable (LDV). A LDV serves two purposes. It can address serial correlation as well as account for alternative determinants of the dependent variable that are not included in the model. However, a drawback of including a LDV is that it might reduce the effect of substantively important independent variables (Achen 2000). We do not attempt to adjudicate the merits or demerits of including a LDV here. However, we present findings with a LDV as a robustness test in model 1. Food security continues to be negative and statistically significant, indicating that higher levels of food security are associated with few domestic terrorist attacks among non-OECD countries.

Model 2 presents the primary findings with five additional controls, namely, inequality, youth employment, FDI, ethnic or religious diversity, and regime durability. 21 Countries with higher levels of inequality may increase grievances and increase the likelihood of terrorism (Piazza 2013). We measure inequality with the GINI index (World Bank 2016). FDI as a percentage of GDP captures economic openness and the existing studies demonstrate a link between the two (Bandyopadhyay et al. 2013). Greater economic openness may enhance economic growth, which could reduce the probability of terrorism (Freytag et al. 2011), but it could also increase pressure on governments to enhance social spending and constrain the ability of governments to do so as well (Burgoon 2006). The data come from World Bank (2016). Unrest due to diversity such as ethnic tensions (Choi and Piazza 2016) may increase probability of terrorism. We control for ethnic diversity to capture this perspective (Alesina et al. 2003). We control for youth employment, as it is theorised that states with large populations of unemployed youth can drive terrorism (Urdal 2006). Finally, the regime durability variable measures durability with the number of years since a regime change where a regime change refers to a 3-point change in the polity score and the data come from POLITY IV (Marshall et al. 2016). None of these controls reach statistical levels of significance but our primary independent variable continues to have a significant effect on domestic terrorism.

Model 3 tests the primary hypothesis by using an alternative measure of the independent variable, food supply per capita per day (FAO 2016). Here again we continue to find support for the effect of food security on domestic terrorism. Overall, the series of robustness tests indicate that specific grievances, specifically food security, play an important role in identifying the root causes of terrorist violence among developing countries. 22

Lastly, we consider the probability of reverse causality where domestic terrorism may affect food security. It is plausible that prevalence of domestic terrorism may disrupt economic activities and hurt the economy, which in turn could create food insecurity. Additionally, terrorist organisations may hinder the transport of essential food items with the objective to delegitimise the government and try to generate support for their cause among the population. Given the lack of adequate instruments for terrorism among developing countries, we utilise the strategy adopted by Hendrix and Young (2014) who address reverse causality between state capacity and terrorism through an error correction model. Prevalence of reverse causality will indicate that changes in the number of terrorist attacks or the number of terrorist attacks in the previous year explain changes in food security after controlling for food security in the previous year.23 The results however indicate that neither of the two terrorism variations (the changes in number of terrorist attacks or lagged values of domestic terrorism) are statistically significant. On the other hand, the level of democracy in the previous year and change in GDP per capita and population are strong predictors of food security. Overall, the error correction model indicates a lack of support that domestic terrorism is a strong predictor of food security.

Conclusion, Future Research, and Policy Implications

Prevalence of domestic terrorism has vast implications for peace and security, especially in the developing world. Even though the extant literature has advanced our understanding of the causes of terrorism, we know relatively little about specific identifiable grievances that motivate such action. This article seeks to fill this lacuna by demonstrating the deleterious effect of food security, and more specifically food availability, on domestic terrorism among developing countries. Our findings contribute to the larger body of research on development and conflict. We focus on a particular facet of conflict, domestic terrorism, and we add to a growing body of research that links food insecurity to violence, more generally (Weinberg and Bakker 2015; Pinstrup-Andersen and Shimokawa 2008; Hendrix and Brinkman 2013; Hendrix and Haggard 2015).

The policy implications of this study suggest that lack of food availability has consequences for peace and security. Tackling the challenges associated with terrorism needs to be two-fold. Governments obviously need to take measures to prevent terrorist attacks to maintain peace and security. In addition to that, the findings of this article suggest that governments also need to develop long-term strategies to meet the core needs of the masses, especially food availability. To this end, we echo Sen’s perspective on adopting a holistic approach to end hunger, which include policies that focus not just on food production but also poverty, education, health care, family planning, and approaching food security as a right-based issue (FAO 2013). Governments have access to a range of policy instruments to ensure food security of the masses, which may include implementation of nutritional programmes that are targeted towards children, pregnant mothers, and provision of quality food to the general population, among others (Shekar et al. 2016).

Overall, domestic governments, international organisations, and foreign powers need to address both the security as well as the core grievance aspects of domestic terrorism in the developing world. Perhaps one of the most pressing and fundamental issues linking the issues of food security to contemporary counterterrorism efforts is that of climate change. There is a growing body of evidence that suggests the impact of climate change will be most acutely felt in the developing world (Busby and von Uexkull 2018). The effects of climate change are predicted to exacerbate the limited state capacity of developing nations, further contributing to the source of grievances that allow terrorist organisations to flourish (Smith 2007). Evidence indicates that this is leading to a rise in militant Islamist extremism in the developing world ‒ ‘climate-induced drought’ has been linked to the growth of ISIS in the Middle East, and the evaporation of Lake Chad in Nigeria has bolstered recruitment efforts by Boko Haram (Gerretsen 2019). As a result, local and global efforts are needed to halt rising temperatures. The most sweeping of these, the Paris Agreement, sets a specific target of holding the increase in the global average temperature to 1.5°C above pre-industrial levels (United Nations 2016). However, the specifics of change are left up to the individual states, and without enforcement mechanisms, many countries, most conspicuously the US and China, are defecting on their obligations (Sengupta 2018). These developments point to increasing relevance of terrorism in the developing world and the important role that food security plays in mitigating its spread.

#### Delhi, Karachi, or Islamabad collapse causes extinction.

Dr. Julian Cribb 19, Adjunct Professor of Science Communication at the University of Technology Sydney and Fellow of the Australian Academy of Technological Sciences and Engineering (ATSE), Principal of Julian Cribb & Associates, “6 - Food as an Existential Risk”, in Food or War, Cambridge University Press

Megacity failure is hard to predict, though it is not hard to identify those cities which are more at risk than others. However, the timing of a collapse depends on so many variables – politics, weather, resources, wars – that it is difficult accurately to predict the onset of particular urban crises. Suffice to say that even a single megacity collapse nevertheless represents a significant existential risk to humanity at large, as the failure of one of these gigantic metropolises, consisting of tens of millions of people, would set off domino consequences for the global economy and all its neighbours in the form of collapsed borders and floods of refugees. It follows that every city on the planet should be planning to avoid such a contingency – and if it isn’t, its city councillors should be fired.

From the perspective of food and war, megacity collapse is one of several probable outcomes of major failures in the global food system, the energy supply or any war which precipitated them. It is one for which few, if any, cities or their governments are prepared. The collapse of a major city or urban region would in turn send shockwaves through the entire global food system, causing prices in unaffected cities and regions to skyrocket and requiring the delivery of food aid on a hitherto unimagined scale and over a very short time-frame – mere days. Other existential outcomes such as disease pandemics and wars are likely. Food and conflict thus play into the risk of megacity collapse – and are also one of the unavoidable consequences. The solutions to this issue are dealt with in detail in Chapters 8 and 9.

#### South Asia radicalization goes nuclear---new doctrine means the next attack is key.

ICG 25, International Crisis Group, independent organisation working to prevent wars and shape policies for peace, provides independent analysis and advice on preventing and managing deadly conflict, combines expert field research with policymaker engagement, founded 1995 in response to Somalia Rwanda and Bosnia conflicts; Comfort Ero, President & CEO; Richard Atwood, Executive Vice President; Elissa Jobson, Chief of Advocacy; Praveen Madhiraju, General Counsel; Brett Moody, Chief Financial Officer; Stephen Pomper, Chief of Policy; Krista van Weelden, Chief of People and Culture; Robert Blecher, Program Director Future of Conflict, "India-Pakistan: Avoiding a War in Waiting," Briefing 185 / Asia-Pacific, 09/17/2025, https://www.crisisgroup.org/asia-pacific/india-pakistan/b185-india-pakistan-avoiding-war-waiting

Tripwires, Threats and a Fragile Peace

After four days of conflict marked by a welter of misinformation, both India and Pakistan declared victory.34 The Indian government said it had honoured pledges to hit the perpetrators of the Pahalgam attack deep into Pakistani territory. The Pakistan government lavished praise on its army and air force for delivering lethal blows against a much larger military adversary. As for the 10 May ceasefire, it continues to hold and the high-level military hotline between the two states has stayed active, reducing the risk of resurgent conflict caused by miscalculations and misunderstandings involving their armed forces. Remaining in periodic contact since 12 May, the DGMOs have agreed to a phased reduction of forward troop deployments along the international border, redeploying personnel to their pre-7 May positions and helping to stabilise the frontier zone. Both militaries also support the creation of a more permanent mechanism for de-escalation.

Although the border is now quiet, the ceasefire has only frozen the conflict, while the hotline between the DGMOs could be disrupted should tensions escalate once again. Both militaries remain on high alert, while neither nationalist rhetoric nor potential triggers of fighting have subsided. The fear subsists that by mistake or intention either side could feel compelled to turn to its nuclear arsenal. An Indian security expert warned that New Delhi’s pre-emptive strikes have arguably destabilised and embittered relations between the two more than strengthened India’s deterrence.35 “Both sides have now declared victory in a conflict that resolved nothing”, one Pakistani security analyst concurred.36

A. Proxy Armed Violence

India and Pakistan have long been at loggerheads over the other’s alleged support for militant and separatist groups operating on their respective territories. The Indian government believes that active Kashmiri militants are entirely a creation of Pakistan, and that the Pahalgam attack was an attempt to undermine the peace and stability it claims to have brought to Jammu and Kashmir.37 Since India attributes all militancy in Kashmir to Pakistan-based jihadist groups supported by Islamabad rather than disaffected locals acting out of their own volition, any major attack of the sort witnessed in Pahalgam threatens to prompt a wave of retaliatory strikes (see more on this in Section III.B).

Establishing the truth of New Delhi’s accusations is no easy matter. While there is no doubt that Pakistan actively supported the insurgency in Indian-administered Kashmir in the late 1980s and 1990s, it is difficult to determine the precise extent of its current support for local militants, despite the ardent claims of the Indian authorities. New Delhi’s August 2019 suspension of Kashmir’s semi-autonomous status, alongside its heavy-handed response to Kashmiri dissent, fuelled public disaffection in the region and gave a fillip to militancy.38 This has led to the emergence of new militant outfits, such as The Resistance Front, which pledge to oppose the reforms New Delhi has sought to impose and which Kashmiris perceive as yet another bid to reinforce central Indian control over the region.39

The strengthening of India’s security apparatus in the region has made it difficult for militants to operate with the same intensity as before.

Hardly a week has gone by in recent years without an encounter between Indian security forces and militants, many of whom have been identified as local Kashmiris rather than solely Pakistani infiltrators.40 As a result, a deadly terror attack has remained a constant threat. “All it takes is two mad men with guns”, one Kashmir-based security official said.41 At the same time, the strengthening of India’s security apparatus in the region has made it difficult for militants to operate with the same intensity as before. Most militants killed since 2019 have been inadequately trained and equipped, and have died within days of joining the armed struggle.42

Pakistan for its part has repeatedly argued that the Laskhar-e-Tayyaba, which it officially banned in 2002, is unable to plan and conduct attacks from inside its border. “Those people, whatever is left of them, they are contained”, Defence Minister Asif insisted days after the Pahalgam attack. Some are under house arrest, while others are in custody”.43 After being banned, the LeT re-emerged as the Jamaat-ud-Dawa, operating as its charity front, which was also banned in 2008 following the terror attack in Mumbai.44 In 2019, LeT leader Hafiz Mohammad Saeed was arrested and convicted on terror financing charges; he is currently serving a 31-year jail sentence. Pakistan also banned the JeM in January 2008 and subsequently its so-called charity arm, the Falah-i-Insaniyat Foundation, in May 2019. The following year, the government froze the properties and assets of both banned groups.45 But U.S and Indian officials believe that the two outfits continue to maintain networks and operate freely within Pakistan.46

On 17 July, the U.S. State Department designated The Resistance Front, the group that had initially claimed responsibility for the Pahalgam attack, a foreign terrorist group, branding it a “front and proxy” of the (already designated) LeT.47 Pakistan’s foreign ministry responded that “any linkage with LeT (…) belies ground realities”, adding that Pakistan “has effectively and comprehensively dismantled” LeT and arrested and prosecuted its leadership.48

Indian officials nevertheless insist that Pakistani denials of any state support for – or even the presence in the country of – anti-Indian jihadist outfits must be backed up by far stronger enforcement action.

Meanwhile, Islamabad holds India responsible for supporting groups that have long targeted security forces and civilians within its territory.49 New Delhi, Pakistani leaders say, instigates terrorism within Pakistan through hardline Baloch separatist outfits such as the Balochistan Liberation Army (BLA) and the Islamist jihadist Tehreek-e-Taliban Pakistan (TTP, also known as the Pakistani Taliban), both of which have inflicted heavy casualties on Pakistani security forces.50 Between January and June 2025, the two groups orchestrated a total of 502 attacks that claimed the lives of 284 security personnel and 267 civilians.51

New Delhi has rejected Pakistan’s claims that it backs anti-Pakistani militants, decrying these accusations as an attempt to divert international attention from Islamabad’s continued support for anti-Indian jihadist groups.52 Even so, both the Baloch separatists and the Pakistani Taliban publicly backed India during the May hostilities.53 The Pakistan military has since claimed that India has unleashed its proxies “to foment terrorism” in the country in the wake of the May attacks.54 On 12 August, after the U.S. State Department added the BLA and its military wing, the Majeed Brigade, to its Foreign Terrorist Organisation list, Pakistan’s interior minister posted on X that “This is a major diplomatic victory for Pakistan and another defeat for our eternal enemy”.55

B. New Military Doctrines

The conflict in May has reshaped the already fraught relations between the two countries in ways that make the current truce hard to sustain. Two days after the ceasefire came into force, Prime Minister Modi said in an address to the nation that India had merely suspended Operation Sindoor, not ended it, and that its future course would depend on Pakistan’s behaviour. “Operation Sindoor has carved out a new benchmark in our fight against terrorism and has set up a new parameter and new normal”, he explained.56 These comments, which he has repeated since then, alongside those of other senior Indian officials, suggest that from now on the government will be inclined to treat any terrorist attack on its territory as an act of war from Pakistan, and consider retaliatory action, including deep into Pakistani territory, as entirely legitimate.57

By erasing the distinction between militants and alleged state patrons in Pakistan, India’s new military doctrine heightens the risk of another conflict. Given that Pakistan will inevitably respond to any Indian attack, it makes the onset of a retaliatory tit-for-tat far more likely.58 Indeed, Pakistan has also appeared to shift its military doctrine, with Foreign Minister Ishaq Dar emphasising that the armed forces’ “quid pro quo plus” response to India’s attacks in May was now the “new normal”.59 The military high command warned India that “any attempt to challenge Pakistan’s sovereignty or territorial integrity, ever again, shall be met with a swift, full-spectrum, and decisive response”.60

Pakistani authorities have also noted that New Delhi’s stance means militants, regardless of their country of origin or ideology, may seek to exploit an opportunity to spark armed conflict between the two states. Bilawal-Bhutto Zardari, Pakistan’s former foreign minister, whose Pakistan Peoples Party (PPP) is a major coalition partner in the Sharif government, has warned against leaving the fate of “our two great nations” in “the hands of these nameless, faceless, non-state actors”.61

Domestic Audiences

Domestic pressures could also play a role in triggering conflict between India and Pakistan. In the wake of the May attacks, the Indian government, having first raised expectations of victory against Pakistan before agreeing to a ceasefire, sought to assuage disappointed supporters at home. Modi’s statement about India merely pausing its military operations against Pakistan could be read in this light.62 Likewise, the Indian military has since made unproven claims regarding its feats during the clashes. Delivering a lecture in Bengaluru on 9 August, the air force chief claimed that Indian planes shot down six Pakistani jet fighters and one other military aircraft – the exact number of Indian planes that Pakistan claimed to have downed in May.63 Fanned by a jingoistic media, the Indian public has been led to expect immediate and successful retaliation as a normal rather than exceptional response to a terror attack. The BJP government’s Hindu nationalist supporters could well demand even more potent military strikes on Pakistan the next time conflict erupts.64

In Pakistan, the Indian attacks brought about the kind of national unity that has long eluded the politically divided country, with the public rallying behind its armed forces.65 Even former Prime Minister Imran Khan’s Pakistan Tehreek-e-Insaf party, which has been immersed in a protracted power struggle with the Sharif government and the military high command, praised the armed forces, lauding their performance against a much larger foe.66

Army chief Asim Munir was a major beneficiary of this tide of pro-military sentiment. In late May, the government promoted him to the rank of field marshal in recognition of his “strategic leadership and decisive role” in the May conflict – the first time that an elected government has granted this title to an army chief.67 Since the military’s domestic legitimacy and its broad political sway will continue to rest on its ability to defend the country’s sovereignty, a robust response to any future Indian strikes is all the more likely.

D. Disputes over Water Sharing

Disputes over water sharing, if left unresolved, also risk fuelling tensions that could potentially spark armed conflict between the two neighbours. After New Delhi placed the Indus Waters Treaty “in abeyance” in the wake of the Pahalgam attack, India’s home minister asserted the agreement would never be restored.68 Calling on India to respect its international obligations under the treaty, Islamabad has warned that it would have no choice but to act, including militarily, should New Delhi store or divert waters of the three western rivers allocated to Pakistan under the treaty. These rivers constitute a lifeline for millions of Pakistanis, accounting for close to 80 per cent of the country’s overall water use, and up to 90 per cent of the water used for irrigation.69

Despite the many frictions in the bilateral relationship since the treaty came into force 65 years ago, it survived unscathed. But India has shelved a treaty that contains no provision for unilateral suspension.70 Pakistan, which is at a disadvantage given its downstream location, has expressed its readiness to discuss modifications to the treaty so as to adapt to India’s evolving needs since it was signed in 1960, including population growth and clean energy. But it has insisted this can only be done through the treaty’s dispute resolution mechanisms.71 On 27 June, the Permanent Court of Arbitration in The Hague ruled that India’s decision did not affect its competence to continue hearing Pakistani objections to two Indian hydro-electric projects.72 A press release by the court noted that “the terms of the Treaty’s object and purpose, do not allow either party, acting unilaterally, to hold in abeyance or suspend an ongoing dispute settlement process.73 On 8 August, interpreting the Indus Waters Treaty, the court’s award said “India shall ‘let flow’ the waters of the western rivers for Pakistan’s unrestricted use”.74

India considers the Indus Waters Treaty to be outdated and unfair, and believes it is high time to revise it. It argues that there has been a fundamental change in circumstances since the treaty was enacted and suspended the treaty in reprisal for the Pahalgam attack, declaring that Pakistan had committed a material breach of the treaty by backing anti-India militants.75 For now, India does not have the infrastructure needed to store or divert the water crossing into Pakistan. But it has plans to drastically reduce the share of water granted to Pakistan under the Indus Waters Treaty by building new dams and other retention structures. After suspending the treaty, Prime Minister Modi reportedly told officials to expedite the planning and execution of such projects.76

Pressing ahead with these plans could spur a hostile military response from Islamabad. 77 Pakistan’s army chief warned on 11 August that “we have no shortage of resources to undo the Indian designs” regarding the Indus waters. “We will wait for India to build a dam, and when they do, we will destroy it”.78

E. The Nuclear Dimension

The May conflict has provided a stark illustration of how the risks of escalation between the two nuclear armed neighbours are higher than in the past. While the four-day confrontation remained far below the nuclear threshold, it was arguably closer to it than ever before. For this reason, India’s new doctrine of systematic retaliation against Pakistan in the event of a terrorist attack raises new dangers. The next time conflict erupts, domestic pressures could prompt India to strike even harder, and trigger an equally forceful Pakistani response. As both sides up the military ante, the demands to hit back and temptations to deploy ever greater force could unfold in ways that both states find difficult to control.79

In his 12 May speech, Prime Minister Modi specifically warned that India “will not tolerate any nuclear blackmail” – in other words, that Pakistan’s nuclear weapons capability will not deter India from attacking it in response to a terrorist attack.80 But the assumption that limited conventional strikes against Pakistan will trigger retaliation that will always remain below the nuclear threshold, and that any ensuing conflict will quickly subside, are hazardous ones.

First officially laid out in 2003, India has a “no first use” nuclear doctrine. Pakistan’s nuclear doctrine, which remains opaque, does not endorse a no-first use policy.81 But neither doctrine necessarily guarantees stable nuclear deterrence in the region. India rules out striking first but its doctrine, branded “credible minimum deterrence”, is based on massive retaliation. In the event of a first nuclear strike, return strikes would aim to “inflict unacceptable damage”.82 The basic tenet of Pakistan’s nuclear policy is also credible minimum deterrence, aimed at warding off Indian nuclear threats or a major conventional attack. But since it is a smaller country and faces a stronger adversary, Pakistan’s nuclear planners say it could deploy nuclear weapons if armed hostilities threaten a major loss of territory or the destruction of its military.83

Pakistan insists that its conventional capabilities are sufficient to counter any Indian attack, as they did during the clashes in May, meaning it has no need to resort to its nuclear arsenal.84 Furthermore, both sides appear to believe that nuclear deterrence will successfully prevent a slide into all-out war. During the May conflict, a senior Pakistani ex-diplomat noted: “India’s reckless actions escalated the crisis to a dangerous level and drove it into unchartered territory – almost to the edge of all-out war. But its military brinkmanship had to stop well short of Pakistan’s known nuclear red lines. Thus, were it not for the nuclear factor, a full-scale war could have broken out”.85 A former top Indian security official concurred that nuclear weapons capability means that both sides were conscious of the need for “managed hostility” that remained below the nuclear threshold.86

Even so, the shared understanding that neither side is willing to endorse a potential nuclear escalation may not be as strong as it seems. In the absence of robust communication mechanisms or effective guardrails to defuse tensions, many observers believe the risk of a slide into all-out war, with nuclear deployment a possible recourse, cannot be ruled out. As an Indian analyst put it, the next crisis could “erupt faster, escalate more intensely, and risk nuclear exchange sooner”.87 Pakistan’s chairman of the Joint Chiefs of Staff appeared to concur. Speaking in late May at the Shangri-La Dialogue forum, Asia’s largest defence conference, he said: “This (conflict) lowers the threshold between two countries who are contiguous nuclear powers”, which implies “greater risk on both sides, not just in the disputed territory (Jammu and Kashmir) but for all of India and all of Pakistan”.88

While both sides insist that deterrence between the two is stable and there is no intention to deploy nuclear weapons, the risks of inadvertent use in a fast-moving, volatile conflict are high.89 For instance, each other’s nuclear intentions could be misread if a missile strike were to hit central military command and control, or cause the death of top civilian leaders. Amid rapidly escalating conventional armed hostilities across a long shared border, and in the absence of robust lines of communication, Indian and Pakistani leaders might have a few minutes to respond to the perceived threat of a nuclear attack.90 The former top Indian security official cited above also cautioned that domestic political pressures could imperil the restraining influence exerted by both countries’ nuclear capabilities on armed conflict.91

Concern that a war between the two states could spiral into the use of ever more deadly weapons is one of the reasons that the recent clashes triggered international alarm. Historically, the U.S. has played a fire-fighting role in South Asia, regularly pulling India and Pakistan back from the brink of war. This influence once again served its purpose during the May crisis. That said, the window of opportunity for diplomatic intervention was shorter than on earlier occasions, and could shrink further if the next crisis starts from a higher rung on the escalation ladder while India’s trust in Washington is wilting.

#### No checks on escalation---spirals to extinction.

Mark Lynas & Ted Nordhaus 25, Lynas is author of "Six Minutes to Winter: Nuclear War and How to Avoid It"; Nordhaus is director of the Breakthrough Institute, "One Nuclear War Can Ruin the Whole Climate," 05/15/2025, https://marklynas.org/2025/05/16/one-nuclear-war-can-ruin-the-whole-climate/

The world is on the brink of a climate apocalypse—not one caused by gradual greenhouse emissions but by a sudden exchange of nuclear weapons, a possibility made more salient by the current conflict between India and Pakistan. While the long-term effects of emissions are uncertain, we know that a nuclear war would result in an immediate nuclear winter.

When we think about nuclear apocalypse, we tend to think of the immediate effects: thermonuclear explosions that incinerate cities and vaporize populations. But the worst consequences unfold long after the weapons have detonated. A major thermonuclear exchange would shroud the atmosphere in soot, plunging the world into darkness and ushering in a decadelong winter. While hundreds of millions of people would likely be killed in the initial conflagrations, most of the human population—including those in the combatant nations—would likely die in the subsequent winter famine.

It’s comforting to think that an exchange of nuclear warheads in a regional conflict such as that between India and Pakistan might be more limited. The death toll from the detonation of a few dozen weapons might only number in the low millions, and there would be little effect on planetary temperatures.

But if India bombed Islamabad and Pakistan bombed Mumbai in retaliation, it would be hard to prevent further escalation. Moreover, once intercontinental ballistic missiles are in the air, it’s virtually impossible for other nuclear-armed nations to determine where they’re headed. Leaders in Washington, Moscow and Beijing would need to make decisions in a matter of minutes about whether to launch their own weapons.

Midrange scenarios involving a few hundred weapons would cool the climate enough to decimate global food production and trade and would likely kill hundreds of millions.

Under worst-case scenarios, droughts and crop failures would quickly spread across the globe. Hundreds of millions of refugees would cross continents in search of food, safety and shelter. Some would die of disease and illness, most of starvation. Human civilization would be over.

### Plan---1AC

#### The United States federal government should remove the Agricultural Fair Practices Act's disclaimer clause, requiring good faith bargaining between distributors and antitrust-exempt farmworker collectives.

### Solvency---1AC

#### SOLVENCY

#### Current law attempts, but fails to build countervailing power for farmworkers by allowing them to join coops. The plan closes a legislative loophole known as the Disclaimer Clause, which currently allows distributors to coerce farmers not to join by threatening to withhold their business. This is better than any regulatory solution.

Dean Zimmerli 15, J.D., Hamline University School of Law, St. Paul, Minnesota, law clerk for the Honorable Douglas L. Richards in the Fifth Judicial District of Minnesota, "Something Old, Something New: Relying on the Traditional Agricultural Cooperative to Help Farmers Solve the Power Imbalance in Modern Meatpacker Production Contracts," 24 S.J. Agric. L. Rev. 59, 2014/2015

[\*73] C. Legal Mechanisms Applicable to Production Contract Farming

Lawmakers, both state and federal, have long recognized that farmers are often in a weak economic position and have responded by enacting various laws addressing those concerns, including laws relating to production contract farming. 106 Federal laws include the Packers and Stockyards Act, the Capper-Volsted Act, and the Agricultural Fair Practices Act. 107 State laws include regulations on certain contract provisions 108 and, in a few states, frameworks allowing joint marketing associations among farmers dealing with meatpackers. 109 In addition, several commentators have proposed solutions to the perceived power imbalances between farmers and meatpackers. Generally these laws and proposals can be grouped into three main categories: laws limiting monopolistic practices by meatpackers; 110 laws directly regulating contract provisions or the use of production contracts in particular situations; and laws aimed at increasing bargaining power on the part of the farmers.

1. Laws Limiting Monopolistic Practices of Meatpackers

[\*74] Recognizing that consolidation among firms can negatively affect the competitive system at the heart of the United States' economy, several laws and proposals have been made to limit that effect. 111 One such law enacted by Congress is the Packers and Stockyards Act ("PSA"). 112 In addition, commentators have proposed various solutions that deal with reducing the power of meatpackers. 113

In response to a 1919 investigation by the Federal Trade Commission ("FTC") which found concentration and unfair monopolistic activities by meatpacking companies, Congress passed PSA in order to combat these abuses. 114 The FTC determined that the five largest packers used their market power to: "manipulate live-stock markets; [r]estrict . . . supplies of foods; [c]ontrol the prices of dressed meats and other foods; [and] [d]efraud both the producers of food and consumers." 115

The PSA is a fairly comprehensive bill, but the meat of the proposal, so to speak, is the prohibition on certain unfair trade practices. Generally, under a PSA, a packer may not "engage in or use any unfair, unjustly discriminatory, or deceptive practice;" "make or give any undue or unreasonable preference or advantage;" buy with the purpose of apportioning supply; manipulate prices; or act with others to do those restricted activities. 116 The most applicable provision out of these with respect to production contracts is the prohibition on unfair, unjustly discriminatory, and deceptive practices. 117 However, the PSA is of limited application to many of the issues noted above absent evidence of particularly bad faith conduct. This is because the courts have interpreted the provision in accordance with the "Rule of Reason," which looks both at the intent of the action and the general effect of the action, weighing both the pro-competitive and anticompetitive effects of the law. 118

[\*75] As applied to most contract provisions, the PSA typically does not restrict them, despite claims that they are "unfair." In addition to considering the Rule of Reason, courts also state that the PSA is not meant to limit freedom of contract. 119 Courts have held that false weighing and deceptive advertising violate the PSA. 120 Other practices have passed scrutiny under the PSA such as using different contract terms between different farmers. 121

Several commentators have suggested that limiting the meatpacking industry's influence and size is the proper solution for the power imbalance common in production contract negotiations. For example, two commentators argue forcefully for more aggressive enforcement of antitrust laws. One suggests that "a tougher policy on mergers" should be adopted by regulators enforcing current antitrust laws such as the PSA and Sherman Antitrust Act. 122 He suggests that mergers between meatpacking firms should be halted absent a "clear showing" that the merger is necessary to achieve a demonstrable gain in efficiency. 123 Another argues that regulators should consider additional anti-competitive factors when evaluating a merger in the meatpacking industry. 124 Rather than simply looking at consumer surplus, she suggests that both the effect on producers and the availability of choice should be considered. 125 This approach is not without its criticisms, as some warn that aggressive antitrust enforcement could result in losses in economic efficiency and higher prices overall. 126

2. Directly Regulating Production Contracts and the Relationship Between Meatpackers and Farmers

Several states have enacted laws directly regulating particular issues related to production contracts, with some states forbidding certain clauses from being included in such written agreements. 127 For [\*76] example, Iowa makes it a criminal and fraudulent act for a meatpacker to insert a confidentiality provision in a production contract. 128 Similarly, federal law prohibits confidentiality provisions that restrict farmers from talking to their lawyers, bankers, accountants, or family members about the terms of the contract. 129 Minnesota has responded to challenges facing farmers who are requested by meatpackers to make capital investments in order to continue doing business with the meatpackers. 130 Under Minnesota law, a meatpacker cannot terminate a contract after requiring a farmer to make an investment of $ 100,000 or more unless the meatpacker gives 180 days advanced notice before termination and reimburses the farmer for certain damages. 131 Minnesota imposes other requirements in production contracts including mandatory mediation provisions, 132 a three day cancellation period after signing, 133 and a requirement that production contracts have cover pages detailing the risks and terms of the contract. 134

Other proposals include better definitions of what constitute "unfair" practices under the PSA as well as limiting the amount of animals that can be acquired through production contracts. Peter Carstensen generally argues that the Secretary of Agriculture should use rule making authority to develop clear standards of what constitutes an "unfair" practice for purposes of applying the PSA. 135 Other proposals have included limitations on the number of animals that could be acquired through production contracts, requiring that a certain percentage be purchased on the spot market. 136

3. Increasing Bargaining Power on the Part of Farmers

Some solutions are aimed generally at increasing the economic power of farmers when dealing with larger companies. Federal legislation includes AFPA as well the Capper-Volsted Act, which is discussed in subsection II.C.4 infra. AFPA gives farmers some protections if they choose to form an association with other farmers to [\*77] bargain collectively with buyers of agricultural products. 137 Some states have further broadened the rights of farmers operating in associations with other farmers. 138

In 1968, Congress passed the AFPA in order to help protect the right of farmers to join associations of other farmers. 139 As with many protective agricultural laws, it was passed in the wake of evidence of larger companies using their market power to abuse farmers who sought to join associations. 140 The resulting law is aimed at prohibiting packers and other buyers of farm products from discriminating against farmers who joined associations. 141 The law prohibits handlers--buyers of agricultural products for later resale 142--from: a) coercing any farmer into joining an association or refusing to deal with a farmer because that farmer is a member of an association; b) discriminating against any farmer on the basis of price or terms because of the farmer's membership in an association; c) coercing or intimidating any farmer into quitting an association; d) bribing a farmer into refraining from being a member of an association; or e) making false statements about associations. 143

Commentators largely agree that AFPA has failed in its ostensible goal because of the "disclaimer" provision added to the bill shortly before it passed. 144 Section five of the bill states "[n]othing in this chapter shall prevent handlers and producers from selecting their customers and suppliers for any reason other than a producer's membership in or contract with an association of producers, nor [\*78] require a handler to deal with an association of producers." 145 By permitting a handler to refuse to deal with a producer "for any reason" other than association membership, it allows a handler to merely point to any other reason, even if that reason is perhaps a mere pretext. 146 Moreover, because the law does not require the handler to deal with an association at all, a handler might simply refuse to deal unless the sheer size of the association forced the handler to come to the bargaining table. 147

Several states have identified the key deficiencies with AFPA and have enacted bargaining laws giving farmers additional rights. Chief among these laws is the Michigan Agricultural Marketing and Bargaining Act, which has been fairly successful in Michigan and served as a model for other states. 148 These laws typically include provisions which prohibit certain unfair practices, give farmers the explicit right to form associations, outline accreditation requirements, and require parties to negotiate in good faith. 149

Duplicating many of the prohibited practices under AFPA, Michigan's marketing association law outlines practices deemed "unfair." 150 It prohibits handlers from "coercing" farmers into joining or restraining them from joining associations. 151 Handlers are prohibited from discriminating against farmers on the basis of their membership in an association; 152 giving loans or money to farmers on the basis of their membership in an association; 153 disseminating false information about an association or other handlers; 154 or refusing to bargain with an association with whom the handler had prior dealings. 155 Michigan's law also protects farmers from the unfair business practices of the associations themselves. Thus, associations are prohibited from publishing false information about handlers or other associations or from coercing a handler into terminating existing [\*79] contracts. 156 The law specifically requires contracts negotiated by the association not discriminate against any individual member of that association. 157

Arguably the most important part of Michigan's marketing association law is the good faith bargaining requirement, which begins with accreditation. 158 After filing for accreditation, a state official determines the size and scope of the accredited association. 159 Once a marketing association is accredited, farmers can then have the association bargain for terms on their behalf. In contrast to AFPA, the Michigan law requires that the association and the handler bargain with each other in good faith, which is defined as the "mutual obligation of a handler and an accredited association . . . to meet at reasonable times and confer and negotiate in good faith." 160 Interestingly, the Michigan law leaves a large gap in its coverage: the "agricultural commodities" covered by the law only includes fruit and vegetables, though other states' laws do apply to livestock. 161

Associations recognized by AFPA and state marketing association laws can provide numerous benefits for farmers. Aside from merely negotiating for better terms or prices, marketing associations can provide "price discovery" among commodities with a low-functioning or non-existent spot market. 162 They can act as a trade association by "sponsoring industry-wide promotional activities, participating in State and Federal lobbying efforts, and collecting industry-wide market data." 163 They can also provide cost-sharing for services, such as legal assistance, that may otherwise be cost-prohibitive for farmers to use alone. 164 Finally, associations may provide universal benefits in enforcing contract reliability by ensuring opportunistic behavior does not occur by either party. 165 Despite these potential benefits for [\*80] producers, the actual utilization by farmers has remained relatively minimal. Bargaining laws exist in about a dozen states but, as of 2002, only about forty marketing organizations existed. 166

4. Agricultural Cooperatives and the Capper-Volsted Act

Farmers have long embraced the concept of banding together to form cooperative businesses which operate for the benefit of all members. 167 The salient characteristics of the cooperative entity include that they are user-owned, user-controlled, and designed to benefit the users. 168 Save for the ownership features of a cooperative, the modern cooperative is a legal entity not unlike most other business entities and is governed primarily by state law. 169

There are four basic types of agricultural cooperatives: marketing (or bargaining), purchasing (or supply), production, and service. 170 In a marketing cooperative, the business markets farmers' commodities on behalf of farmers either through purchasing the goods from the farmer and reselling them, or performing bargaining and other services on the farmer's behalf. 171 Some marketing cooperatives carry out additional functions, ranging from "first-stage processing such as ginning cotton or hulling nuts" to fully integrated production such as "processing products for the consumer or industrial markets." 172 A supply cooperative purchases supplies farmers need in large quantities and sells those supplies to the farmer members, allowing the farmers to [\*81] take advantage of bulk pricing. 173 A remarkably successful and well known example of a cooperative that combines both marketing and supply functions is Land O'Lakes, Inc. Through its feed arm dominated by Purina Mills, Land O'Lakes operates as a supply cooperative providing feed for farmers' animals. 174 Land O'Lakes operates as a marketing cooperative for thousands of member dairy farmers by purchasing raw milk from farmers and processing it into dairy products sold in stores. 175

Not unlike the situation facing many livestock producers today, farmers of the early 20th century also faced challenges when dealing with larger, more powerful buyers. Congress recognized that "[f]armers were perceived to be in a particularly harsh economic position," and were generally left with no choice in who to sell to. 176 Moreover, Congress believed that due to their poor economic bargaining position, many farmers were likely taken advantage of by larger processers. 177 Cooperatives were viewed as a remedy for this power imbalance. 178 There was concern, however, that antitrust laws would be applied to farmers acting together in a cooperative, rendering their organizations illegal. 179 The response to this concern was the CVA. Passed in 1922, the CVA specifically permitted farmers to act collectively:

Persons engaged in the production of agricultural products as farmers, planters, ranchmen, dairymen, nut or fruit growers may act together in associations . . . in collectively processing, preparing for market, handling, and marketing in interstate and foreign commerce, such products of persons so engaged. Such associations may have marketing agencies in common; and such associations and their members may make the necessary contracts and agreements to effect such purposes. 180

[\*82] With this permission, farmers could act collectively without fear of violating antitrust laws. Cooperatives have flourished under the CVA. 181

There are some limits on the organizational structure and management of cooperatives. Cooperatives must operate on a strict one-vote-per-member rule, must not pay dividends on stock in an amount exceeding eight percent per year, and the majority of the business must come from members. 182 Moreover, the protection from antitrust prosecution is not absolute. A cooperative that acts in a predatory manner such that prices are "unduly enhanced," or engages in activity that has no "legitimate object" for the cooperative other than to stifle competition, can still face penalties under antitrust laws. 183

Moreover, the Supreme Court has clarified that the cooperative membership must be made up entirely of "farmers" within the meaning of the CVA. In National Broiler Marketing Association v. United States, 436 U.S. 816 (1978), the United States brought an antitrust suit against an association of integrated poultry processors. 184 Some of the member processers were involved only in slaughtering chickens and did not own chickens or grow-out facilities. 185 The court held that such members were not "farmers" within the meaning of the CVA and thus the cooperative was not exempt from antitrust prosecution. 186

[\*83] III. DISCUSSION AND PROPOSAL

Livestock farmers face a number of challenges in today's modern economy. The solution, however, is not dramatic regulation of the industry, but rather a renewed reliance on the traditional agricultural cooperative. Farmers could rely on cooperatives to bargain collectively as a group or to run and manage meatpacking facilities themselves. Bargaining collectively as a single economic unit would give farmers more leverage during negotiations. Alternatively, operating packing facilities themselves would likely result in farmer-friendly contracts as well as ensure that whatever profits accrued to the meatpacker would be distributed and shared by the farmers. Because the vertically integrated model could remain in place under either approach, many of the benefits provided by the use of production contracts would remain as well.

A. Cooperatives as Collective Bargaining Units for Farmers

One of the primary uses of agricultural cooperatives is as an entity to jointly market and sell agricultural commodities on behalf of the member farmers. 187 Groups of livestock producers banding together through a cooperative to negotiate with a meatpacker could likely result in a more equal bargaining position for farmers. With enough economic clout, cooperatives could extract concessions from meatpackers or at least a higher price to compensate for taking on additional contract risk. Finally a cooperative would be in a solid position to take advantage of AFPA and state marketing laws already in place.

1. Negotiating with Meatpackers as a Cooperative

As a starting point, commentators today, as well as legislators in the past, have recognized a serious power imbalance as a cause for the poor economic position farmers often face. Just as in 1922, when the CVA was passed, farmers raising livestock today under production [\*84] contracts are "in a particularly harsh economic position." 188 The proper solution today is the same solution made available almost 100 years ago: band together as a cooperative to create an economic entity that can bargain effectively with buyers.

An individual livestock farmer today has very little bargaining power when dealing with a large meatpacker. 189 While a single meatpacker may be the only sensible output for all of a farmer's livestock, the typical farmer only accounts for a small percentage of the meatpacker's total inputs. The meatpacker cares little if a single farmer rejects a production contract and refuses to raise animals for the meatpacker because the lone farmer represents an insignificant portion of the meatpacker's capacity. On the other hand, a farmer might have only one or two meatpackers in the area with whom to raise animals for. The farmer might have significant debts and other expenses such that a guaranteed payment stream through a production contract is necessary. Or, if the farmer raises poultry, there may be no alternative but to deal with meatpackers through production contracts because there is no functioning transactional market. Facing this reality, a lone farmer is often obligated to accept whatever terms the meatpacker presents him.

The cooperative business model, coupled with the protections afforded by the CVA, gives farmers an effective means to alter this power imbalance. The CVA specifically allows "persons engaged in the production of agricultural products" as farmers and ranchmen the ability to act collectively in "marketing" agricultural products. 190 Also, the CVW permits cooperatives to operate marketing agencies and "make the necessary contracts and agreements" to carry out their purpose. 191 The CVA protections apply to today's livestock farmers just as it applied to farmers in the early 20th century. Even in the case of a farmer who does not, under the terms of the production contract, own the animals he is raising, he is nonetheless engaged in the production of agricultural products, thus falling neatly within the coverage of the CVA. 192 The cooperative's primary role in such a [\*85] situation would be to act as a marketing agency on behalf of its members. By operating as a marketing agency, the cooperative would represent the collective group of member farmers as well as their livestock for sale.

Provided the cooperative represents a sufficient percentage of the livestock market within an area, it could serve as a sufficient counterweight to the sizeable meatpacker. Where fifteen or twenty percent or more of the supply that might go to a single packing plant is represented by a cooperative, the meatpacker would be much more reluctant to have that group of farmers reject their production contract compared to a single farmer rejecting a contract. As such, the meatpacker would be willing to come to the table ready to negotiate on contract terms and pricing. The cooperative could then negotiate a contract on behalf of its members. This type of collective bargaining falls exactly in line with the purpose of the CVA, the proponents of which wanted farmers to be able to act together when dealing with larger buyers. 193

There may be various approaches a cooperative could take when structuring such a deal. For example, a cooperative could negotiate a master agreement that contains the various terms and conditions apart from quantity, leaving individual farmers to contract according to their capacity. Alternatively, the cooperative could contract to sell directly to the meatpacker and then serve as the buyer from individual farmer members. This latter approach would help to shift much of the contract risk to the cooperative thereby spreading it among all of the members. For example, the risk of slow payment could be eliminated if the cooperative paid the farmers immediately upon delivery while the cooperative waited for payment from the meatpacker. At the same time, improperly delaying payment or manipulating the payment to the cooperative could carry a significantly greater risk for the meatpacker compared to withholding or delaying a payment to an individual farmer because the cooperative would have the means the litigate the matter and may well have enough at stake to make litigation worth it.

2. Taking Advantage of Rights under AFPA and State Marketing Laws

[\*86] Farmers are given rights under AFPA and state marketing laws to take advantage of the cooperative form. Under AFPA, meatpackers are prohibited from discouraging the formation of cooperatives. 194 State marketing laws provide mechanisms which impose negotiation requirements for meatpackers who might otherwise not want to deal with a cooperative. 195

Meatpackers are prohibited under AFPA from doing many acts that discourage membership in an association such as discriminating with respect to price based on a farmer's membership, refusing to deal with a farmer because of their membership, intimidating farmers into not joining or into quitting, or bribing farmers. 196 The CVA uses the term "association" interchangeably with "cooperative," and similarly, "associations" under AFPA would include associations organized as cooperatives under state law. 197 Therefore, the protections of AFPA apply to livestock farmers seeking to form or join a cooperative.

Cooperatives could take advantage of state marketing association laws if meatpackers refused to freely negotiate with them regarding the terms of the contract. Some state marketing laws, such as those modeled after Michigan's Agricultural Marketing and Bargaining Act, extend that coverage to livestock producers. 198 Where the size of the cooperative alone does not induce a meatpacker to bargain with a cooperative, the cooperative could seek accreditation under a state marketing act and relying on the good faith bargaining requirement to bring the meatpacker to the table.

B. Cooperatives as Meatpackers

[\*87] An alternative to bargaining with the meatpackers is to completely cut the meatpackers out of the equation by using a cooperative to operate meatpacking facilities. Cooperatives using this approach would be able to avoid the challenges of negotiating with a meatpacker entirely and, at the same time, generate profits for their members.

One function of a marketing cooperative is to handle and process agricultural products for resale to consumers. 199 The CVA applies to cooperatives that engage in "collectively processing, [and] preparing for market" agricultural products. 200 Thus, it expressly permits a cooperative to purchase its members' products and process them for resale. In the case of livestock farmer cooperatives, this would involve purchasing live animals from farmers and slaughtering and processing the animals for resale to consumers or other buyers.

Such activities were implicitly deemed acceptable in National Broiler Marketing Association. 201 The Supreme Court analyzed whether a group of poultry processors were able to claim the antitrust exemption of the CVA; ultimately the court decided that the fatal flaw in their CVA claim was the fact that a number of members did not raise any animals or own any grow out facilities. 202 The court was not, however, concerned that the members or the association engaged in meatpacking operations. There is no concern that a cooperation operating a meatpacking facility on behalf of its members would fall outside the protections of the CVA. 203

Using a cooperative to operate a meatpacking facility would provide two distinct benefits for farmers. First, farmers raising livestock on behalf of their cooperative would not face an adversarial bargaining situation. Cooperatives are both operated under the members' control as well as operated for the benefit of the members. Because of these unique organizational characteristics, cooperatives would have no incentive to impose unfair contract obligations on members. 204 There is no reason to believe that a cooperative would seek to impose as aggressive of contract provisions when entering into what is [\*88] essentially a friendly transaction. Moreover, the profits currently being acquired by meatpackers could potentially be realized by the cooperative itself. When reselling the processed product to grocery stores or restaurants, the cooperative will generate revenue for the business. To the extent the venture is profitable, the cooperative's profits will generally be passed on to the farmer members under the principle that the benefits of the cooperative are passed to the members.

The model of processing agricultural goods as a cooperative is successful in other areas. For example, Land'O Lakes, Inc., a cooperative primarily of dairy farmers, processes raw milk into a variety of finished food items such as milk and butter. 205 Land'O Lakes has grown into one of the largest and most recognizable food brands in the world. 206 A meatpacking cooperative that was able to establish a brand presence could one day be able to experience success similar to that of Land'O Lakes.

C. Relying on Cooperatives Rather than Regulation

Lawmakers and commentators had proposed various solutions to the power imbalance facing livestock farmers with production contracts. These include enforcing antitrust laws more strictly against meatpackers or determining what must or cannot be included in a production contract. 207 Unfortunately, these solutions impose unnecessary burdens on the entire industry, resulting in inefficiencies or cost shifting.

One solution proposed is prohibiting mergers among meatpackers except in limited situations. 208 The aggressive antitrust approach could result in inefficiencies leading to higher prices for consumers. By prohibiting mergers, regulators would ensure that less profitable businesses would not be swallowed up by more profitable businesses for the sake of keeping a diversified market. The result is that less [\*89] efficient competitors would remain in the market leading to higher prices for consumers. Moreover, synergistic gains from eliminating redundant management and other fixed costs would remain as well; these costs represent savings that would not be passed on to the consumer post-merger.

The aggressive antitrust enforcement approach would do little to effect the industry that is already in place. In the first instance, it is not clear that consumers necessarily benefit from additional choice when the product is essentially a commodity. The history of the industry shows that consumers prefer the low price product so long as they are assured that it is at least of equal quality. 209 Though some consumers might pay more for meat labeled organic or natural, the reality is that they represent only a small portion of the public. 210 Moreover, because the market is already dominated by large meatpackers, without breaking up firms into constituent companies much smaller than their current size, farmers would remain unable to bargain effectively with meatpackers. Thus not only would the aggressive antitrust enforcement solution likely cause efficiency losses, it would also be ineffective at improving farmers' economic position vis-á-vis the meatpackers.

Various laws have been enacted that directly regulate production contracts. Among these are Iowa's prohibition of confidentiality clauses and Minnesota's regulation on capital investment requirements. 211 These provisions do manage to eliminate specific objectionable provisions, but do not necessarily result in an overall increase in welfare for farmers. To the extent meatpackers are able to shift other risks to farmers or decrease the price paid to compensate for the mandated contract provisions, farmers are no better off.

By putting farmers in a position that they can negotiate with meatpackers effectively, real bargaining can occur allowing each party to evaluate what contract provisions are desirable to retain. Though the contract provisions outlined in this article can be construed as unfair to [\*90] farmers, most provide a legitimate benefit to the meatpacker. For example, where the meatpacker has made significant investment in the animals and feed and stands to lose the entire investment if the farmer fails to care for the animals, the takeover provision provides a method to protect their investment in such an emergency. 212 The confidentiality provision could be helpful for protecting trade secrets or other information that is valuable to the meatpacker. 213 Where a cooperative has enough negotiating leverage due to its size, it will be able to attempt to bargain for a higher price or for concessions on other terms if the meatpacker determines that, for example, a takeover right is necessary. By leaving these terms up to the parties, they can reach agreeable terms, rather than terms imposed by legislators.

D. Challenges for Cooperatives as a Solution to the Power Imbalance

The fact that livestock farmers, for the most part, have not taken advantage of cooperatives does raise some questions on the viability of this proposed solution. Despite these questions, cooperatives remain a viable tool going forward.

Perhaps the biggest reason livestock cooperatives have not been used as a solution yet is because the problem is a relatively recent one, at least outside the poultry markets. Serious consolidation within the entire meatpacking industry did not begin until the 1980s. 214 In 1994, only six percent of pigs were produced under production contracts--a number that quadrupled in just six years. 215 Also, even with the protections of AFPA in place, it is possible that meatpackers discouraged, overtly or covertly, the formation of cooperatives that might challenge their market position. Going forward, there needs to be a critical mass of farmers that take the initiative to form a cooperative to deal with a specific packing plant or meatpacker. Because such a startup would take a relatively large amount of effort, there would likely need to be some sort of specific impetus to get the project off the ground. Without such a triggering event, inaction will likely always be an easier course.

[\*91] Even with these challenges, cooperatives of livestock farmers present a viable solution. Farmers are familiar with working through cooperatives because they are extremely prevalent within the agricultural industry. 216 Indeed, for established cooperatives with influence over a geographic area, it would likely be a relatively easy feat to start an arm of the cooperative that works exclusively on behalf of livestock farmers. Even where an established cooperative would not want to start a new operation, starting a new marketing cooperative to bargain on behalf of farmers would not be an impossible task. The capital required would be relatively small compared to the benefits it could provide members. Certainly as the use of production contracts becomes more prevalent in other sectors of the livestock industry, the use of cooperatives will become more attractive.

The formation of cooperatives is only as useful as the interested parties make it. Laws prohibiting certain practices or contract terms are only effective if farmers assert their rights and regulators police the industry. Laws limiting monopoly power are only effective where there is willingness to aggressively police mergers. Similarly, laws encouraging collective action on behalf of farmers are only useful where farmers take the initiative to band together. As the meatpacking industry continues to consolidate and production contracts become more and more common, the need for livestock cooperatives will only grow.

IV. CONCLUSION

The rapid changes in agriculture over the past half-century have left livestock farmers in a poor economic position. Particularly in vertically integrated livestock farming, farmers are often at the mercy of a much more powerful meatpacker when negotiating contracts, which often leads to little or no negotiation at all. 217 Farmers who have invested heavily in the equipment and facilities needed to operate their livestock farm must accept unfair contract terms or risk serious financial consequences. The result is an industry that saddles farmers with risks and allows wealth to accumulate in the meatpackers.

Numerous laws have been passed addressing this issue, and many commentators have advocated for their own solutions. However, the [\*92] solution for this modern problem lies in the common cooperative form, which was expressly validated by the Capper-Volsted Act nearly 100 years ago. 218 By negotiating collectively through a cooperative, farmers would be able to improve their negotiating position so that they are not stuck dealing on a take-it-or-leave-it basis with meatpackers. Alternatively, farmers could operate meatpacking facilities of their own through cooperatives. Farmers utilizing this method would be able to see the profits from the meatpacking activity flow back to them. Through these solutions, a farmer's position in the modern food industry can improve.

#### Disclaimer clause preempts stronger state laws.

Donald A. Frederick 93, Program Leader, Legal, Policy & Taxation, Agricultural Cooperative Service, United States Department of Agriculture, Washington, D.C., "Legal Rights of Producers to Collectively Negotiate," William Mitchell Law Review, vol. 19, Spring 1993, pp. 433-443, Lexis

The disclaimer clause of AFPA provides that "nothing in this chapter shall … require a handler to deal with an association of producers." 148 The provision may call into question state statutes requiring a processor to negotiate in good faith with a producer association. The disclaimer clause also raises [\*451] concerns over how far a state can go in compelling a processor to accept third-party intervention in the negotiation process. 149

From the producer's perspective, other weaknesses exist in legislation, particularly at the federal level. Under the disclaimer clause of the AFPA, processors can terminate producer contracts for virtually any reason other than the producer's participation in a cooperative. 150 Because of this narrow coverage, processors could easily formulate a legitimate reason justifying termination regardless of whether cooperative participation was the real motivation behind the termination of the contract.

Federal law is devoid of procedures to facilitate negotiations between a processor and a grower association. Often, if the parties are able to sit down and talk with a neutral, trained outside person, differences can be resolved and amicable agreements can be reached. While several states have undertaken to provide professional assistance in the negotiation process, 151 the federal government has not found it appropriate to offer this service on a nationwide scale.

Penalties under federal law for violating producer rights are modest, at best. Private parties can collect damages and attorney's fees. 152 The cost of private litigation, however, forces most grower associations to rely on the government to pursue their cause.

Even when the government files suit on behalf of a grower association, the only remedy available is a civil complaint re [\*452] questing preventive relief to bar further illegal conduct. 153 As a result, the Justice Department is reluctant to expend the resources necessary to pursue these cases. Even if the case is successful, the processor is no worse off than if it had not violated the law initially. Current enforcement tools provide little inducement for voluntary compliance on the part of processors.

Federal law does little to facilitate purposeful bargaining. State law that exceeds the scope of the AFPA is exposed to possible federal preemption charges. The lack of uncompromised public policy support puts producer associations in a "chicken-or-the-egg" situation. Producers are reluctant to join an association until the association has shown the ability to withstand processor pressure. Yet, an association cannot obtain significant bargaining power until its membership represents a large enough share of production that the processor has to respect the association.

Some producer groups have developed sufficient market presence to command processor attention. 154 Many other producers, however, remain unorganized or unable to become a force in their industry. A more favorable public policy toward agricultural bargaining would facilitate stronger, more effective farmer associations.

B. Steps to Improve Producer Bargaining Power

Repealing the disclaimer clause would eliminate the AFPA language that states that handlers and producers are not required to deal with producer associations. 155 This repeal would remove the cloud over state laws that promote good faith negotiation and third party assistance in reaching a settlement. In addition, repealing the disclaimer clause would remove any inference that processors can refuse to do business with an association member for reasons other than membership in the association. 156

Producers could also benefit from an amendment designating failure to bargain in good faith as a prohibited practice under section four of the AFPA. To avoid self-contradiction, an amendment requiring good faith bargaining should be accompanied by a repeal of at least that portion of the disclaimer clause which states that handlers do not have to deal with producer associations. 157 These amendments would insure that some discussion or negotiation would occur. Once the parties are talking there is reason to hope for a negotiated contract. In addition, producers who fail to engage in honest negotiation could be subject to legal action or sanctions.