ESSAYS IN LAW AND ECONOMICS

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ESSAYS IN LAW AND ECONOMICS

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1. Introduction

If there is a central thesis to this dissertation, it is that legal issues can benefit from economic analysis in every stage of the legal process. Whether it is by explaining legal constructs from a behavioural perspective ex post, or by using economic concepts to inform legislative decisions ex ante.

This dissertation bundles a number of papers that find themselves on the intersection of the fields of law and economics. Researchers in either field can learn from the insights of the other. Due to the interdisciplinary nature of this dissertation the various chapters are written for varying audiences. Some are directed at legal scholars, introducing insights and techniques from economics, while others are directed at economic scholars, introducing new applications and contexts for well-known concepts. This variation in target audiences is why some chapters display more emphasis on legal issues, and other more emphasis on economic issues.

Economics can help determine the rationale of individuals' behaviour both in situations of certainty and uncertainty, by looking at incentives and possible consequences of behavioural choices, which is done both in Chapter 2 and in Chapter 5. Economics can also help to create insights into the rationale and goals of legislation, which is done in Chapters 2 and 3, where economic methods are applied to legal questions. Economics can also explain how preferences and information asymmetries influence the outcomes of negotiations between multiple parties, which is done in Chapters 4 and 5, where economic concepts are applied in legal contexts.

Chapter 2 discusses the rationale of negligence rules. It deals with situations where individuals make decisions on whether to take a costly measure to prevent a possible harm from occurring. For example a cyclist can decide whether to wear a helmet to protect himself from head injury. However, whether or not he might get a head injury also depends on the behaviour of other individuals, in this example a driver. The driver can decide whether to look in his mirrors before he turns a corner and with that influence whether or not the cyclist might get a head injury. If the harm occurs then there is also the judge who has to determine ex post whether or not the cyclist did wear a helmet and whether the driver did look over his shoulder and whether we should expect either individual to do so to determine whether either of the individuals was at fault. And then lastly, the judge has to apply the negligence rule to determine which individual has to bear the damages.

There are various negligence rules that deal differently with determining who has to pay the damages in a situation where there are two individuals involved and neither took measures to prevent the harm from occurring. However, comparative negligence, which shares the damages between the two individuals, is the most common rule applied both in Europe and the US.[1] In Chapter 2 we use game theory to show that this particular negligence rule creates incentives that induce efficient behaviour in certain situations where other negligence rules do not. A judge can make a mistake in assessing what the optimal standards of care were, for example by setting the due care standards too high, or in the example of the cyclist and the driver, by expecting the cyclist to wear full body armour, and to expect the driver to stop at every intersection to get out of the car and check in every direction whether a cyclist approaches. In such situations, where judges err in assessing the due care levels, negligence can be the optimal behaviour.

The intuition behind this is that comparative negligence shares the damages between two individuals involved, as opposed to other negligence rules that appoint the damages to one individual only. When one individual will bear the full cost of the damages the threshold to make negligence a rational choice for that individual is relatively high. And once one individual decides not to be negligent this transfers the full expected cost of damages onto the other individual, if he were to be negligent. This transfer of the expected costs creates a similarly high threshold for negligence for that individual. The sharing of the damages in comparative negligence lowers the expected costs of negligence for either individual, and hence lowers the threshold to make negligence the optimal behaviour for either individual.

We show that comparative negligence induces negligence when it is efficient, in situations where other negligence rules do not, and we also show that the optimal sharing rule is one of relative fault, sharing the damages proportional to the individuals' relative departures from due care.

Chapter 3 shows how the application of statistical methods can shed light in the field of comparative law. A structured overview is created of all existing legislation on a specific topic: the protection of traditional knowledge (TK). Factor analysis allows for an in-depth analysis of underlying concepts of the legislation, that so far were not found through conventional comparative law methods. Through the application of this methodology a theory of three approaches is introduced, explaining that the existing legislation on the

[1] Curran (1992); Calabresi (1997 p. 2206); Best (2007); Robinette and Sherland (2003); van Dam (2006, pp. 334-335); and Artigot I Golobardes and Gomez Pomar (2009, pp 48-52).

protection of TK can be subdivided into three distinct approaches, each with specific characteristics such as goals of the legislation, what it protects TK from, and whom it is protected for. The three approaches found are: the economic empowerment approach, through which the legislator seeks to create opportunities for the economically weaker indigenous groups in society to monetize on their traditional knowledge; the preservative protection approach, in which the legislator seeks to preserve folklore for the future and for the benefit of the country as a whole; and the cultural integrity approach, used to prevent the offensive and inappropriate use of sacred culture, historical objects and authentic new traditional knowledge products. The Theory of the Three Approaches is shown to explain up to 81% of the variation found in the legislation.

Chapter 4 applies economic concepts, mainly borrowed from economics of federalism, to analyse the potential benefits from hypothetical international agreements. Chapter 4 continues in the realm of TK, it applies the results of Chapter 3 and uses the Theory of the Three Approaches as a proxy for the preferences of negotiating parties in international negotiations on the protection of TK. It analyses reasons why international negotiations on this topic have been unsuccessful thus far. It discusses whether the possibilities exist for gains in efficiency and effectiveness in the regulation of the protection of TK if international agreements are formed. It also discusses where potential losses in efficiency and effectiveness might occur if international agreements are formed. Combining these results leads to a conclusion in which approaches there is potential gain from international negotiations, and in which approaches there is not.

Chapter 5 analyses the rationale of individuals' behaviour in situations of uncertainty. It looks at information aggregation in groups of individuals, who are trying to make an optimal decision under uncertainty, based on the information present among the individual group members. We use statistics to develop a framework of analysis capable of dealing with various forms of choices: the Generalized Jury Theorem. We show that the Generalized Jury theorem should be used to model the behaviour of jurors, in situations where jurors have a common goal and can communicate before voting.

The intuition behind the Generalized Jury Theorem builds on the original premise of Ramond Llull (1232-1316) that the quality of a decision based on the aggregation of individual bits of information is determined by the quality of the individual bits of information and by the way the information is aggregated. The Generalized Jury Theorem shows that as long as the individual jurors share a common goal and are given the possibility to communicate prior to voting, it is in all the jurors' interests to truthfully

reveal their private information. The reason for this is that this will allow them to make a decision that best fits their shared preferences. Once all information is shared, the decision should be reached unanimously as the optimal decision is then known. This means that there is full revelation in equilibrium, irrespective of the voting rule used.

Our framework builds on Condorcet's Jury Theorem, however, Condorcet's Jury theorem can only be applied to binary choices, while the Generalized Jury Theorem can be applied to a broader set of choices including to decisions over a continuum. In other words, Condorcet's Jury Theorem can only be applied to juries dealing with yes/no questions, like whether a defendant is guilty, while the Generalized Jury Theorem can be applied to broader questions, like decisions on what the speed limit should be on a motorway. Condorcet's Jury theorem can be seen as a special case of the Generalized Jury Theorem.

Chapter 6 provides conclusions and a brief outlook for future research building on the work presented here.

2. Relative Fault and Efficient Negligence: Comparative Negligence Explained

This paper is co-authored with G. Dari-Mattiacci and published in the Review of Law and Economics, June 2013; 9(1): pp. 1-40.

ABSTRACT

This paper shows that the rule of comparative negligence with relative fault - a sharing of the loss proportional to the parties' relative departures from due care - induces the parties to an accident to be efficiently negligent. Comparative negligence is more efficient than simple or contributory negligence regimes because it serves as a buffer against excessive due-care standards. If due-care standards are too high, comparative negligence facilitates efficient negligence, inducing parties to violate excessive due-care standards only when this is socially desirable. If due-care standards are too low, all negligence rules perform in the same way. Of all possible comparative negligence rules, relative fault provides for the sharing rule that maximizes this effect. The same principle also applies to the contribution rule among multiple tortfeasors.

2.1. Introduction

The efficiency of comparative negligence poses a persistent puzzle to law and economics scholarship. Although many notable attempts have been made to pinpoint the reasons for its widespread use, a generally accepted theory of comparative negligence has eluded scholarly efforts. Moreover, the actual apportionment of damages between two negligent parties is a question that rarely emerges in digested opinions and has not been resolved by scholarship.[2]. In *Wilson v. R&C Serv. Co.* the jury determined that the plaintiff was 29% comparatively negligent.[3] Although juries do not shy away from very precise determinations of comparative fault, it is not clear how such numbers are or ought to be produced.

When an accident can be prevented if both the victim and the injurer take care and the costs of care are $1 for the injurer and $99 for the victim, which party should bear the largest share of damages? Intuition and precedent[4] suggest that the party that could have taken care at a negligible cost and failed to do so bears greater responsibility for the accident and should bear a correspondingly greater share of damages. We will show that this argument is misleading and the party with the greater cost of precaution should bear more liability. We propose a novel theory that explains why comparative negligence is more efficient than its all-or-nothing alternatives (simple and contributory negligence) and makes an efficiency case for a particular sharing of the loss between negligent parties proportionally to relative fault – that is, the parties' relative departures from due care.

Consider the following example:

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[2] The apportionment of damages is generally determined by the trier of fact in a non-transparent way. The Uniform Comparative Fault Act, Sec. 2.b states that "In determining the percentages of fault, the trier of fact shall consider both the nature of the conduct of each party at fault and the extent of the causal relation between the conduct and the damages claimed." See also *Watson v. State Farm Fire & Cas. Ins. Co*., 469 So. 2d 967 (La. 1985) and Restatement (third) of Torts: Apportionment of Liability §8 (2000) detailing the factors that should bear on the determination of the parties' comparative fault. Cfr. (Parisi 2004) dealing with the sharing of the loss between two non-negligent parties.

[3] CV990081115S, 2003 WL 716658 (Conn. Super. Ct. Feb. 19, 2003). Different numbers emerge from litigated cases: the plaintiff's comparative fault was assessed at 20%; in *Allen v. Perry,* 722 S.W.2d 98, 100 (Mo. Ct. App. 1986), at 33%; in *Griffin v. LeCompte*, 471 So. 2d 1382, 1389 (La. 1985), at 40%; in *Jensen v. ARA Services, Inc*., 719 S.W.2d 121, 122 (Mo. Ct. App. 1986), at 60%; in *Vincent v. Pabst Brewing Co*., 47 Wis. 2d 120, 123, 177 N.W.2d 513, 514 (1970), and at 66%; in *Griffin v. LeCompte*, 471 So. 2d 1382, 1389 (La. 1985).

[4] *Dobson v. Louisiana Power and Light Co*., 567 So.2d 569 (La. 1990).

Example 1. An accident can be prevented if both Xavier (the injurer) and Yvonne (the victim) spend \$60 on care. Care taken by only one party has no effect.[5] If an accident occurs, damages amount to \$100

Clearly, the accident should not be prevented because the total costs of care (\$60+\$60=\$120) are larger than the accident loss (\$100). A court should not find the injurer negligent in this case. To apply the Hand formula[6] correctly, the court needs to estimate the parties' costs of care, compare these with the damages resulting from the accident, and find that the former are larger than the latter. What if the court makes a mistake and holds the injurer liable? Under simple negligence, the injurer faces a choice between spending \$60 on care and paying \$100 in damages and will opt for the former. Given that the injurer can be expected to take care, the victim faces a choice between preventing the accident (\$60) and bearing the accident loss (\$100), and will also take care. Under simple negligence, a wrong determination of negligence induces both parties to take precaution in a case when they should not. (The same result occurs under contributory negligence.)

Under comparative negligence, if both parties are found negligent the loss is shared (say, at 50%). If a party believes that the other party will not take care, the best choice is not to take care because the per capita liability share amounts to \$50 while taking care would cost \$60. Thus, comparative negligence leads to an equilibrium in which both parties are efficiently negligent.[7] Unlike all-or-nothing rules, the sharing of the loss induces the parties to choose the same action that they would choose if they could cooperate and allows them to offset the error made by the court. This equilibrium is preferable for the parties and is the socially desirable outcome.[8] The example above shows that comparative negligence could create a sharing of the loss that reduces social costs compared to all-or-nothing rules. Since the optimal sharing will not necessarily be 50%, what sharing rule should the court apply when apportioning damages between the parties?

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[5] The assumption that unilateral care does not affect the accident loss is innocuous and is made only to simplify the examples. The model that we present in section 2.4 considers the general case where unilateral care may or may not reduce the accident loss.

[6] United States v. Carroll Towing Co., 159 F.2d 169 (2d. Cir. 1947).

[7] The notion of efficient negligence has been introduced by Grady (1998) in the context of inadvertent violations of the due-care standard. See also Grady (1990). In the conclusion, we will explain how our theory relates to Grady's theory.

[8] The equilibrium where both parties take care persists but is unlikely to be chosen because it entails higher costs for each party. Mixed strategy equilibria are unstable. In contrast, the negligence equilibrium is stable and is the Pareto efficient equilibrium (and hence a focal point).

Example 2. An accident can be prevented if both Xavier (the injurer) and Yvonne (the victim) take care. Care taken by only one party has no effect. Care costs Xavier $30 and Yvonne $90. If an accident occurs, damages amount to $100.

In *Dobson v. Louisiana Power and Light Company*,[9] the court concluded that if the defendant's cost of care is less than that of the plaintiff, then the defendant's fault is the greater of the two. Thus, Xavier should bear a greater share of liability than Yvonne. The court does not offer a precise formula to calculate such shares but *any* apportionment rule that assigns more than 50% of the damages to Xavier would induce both parties to take care: Xavier would prefer to take care ($30) rather than bear his share of damages ($50 or more). Given this choice, Yvonne would prefer to spend $90 on care and avoid the accident rather than bear the accident loss ($100). Although appealing and seemingly fair, a sharing rule that assigns more liability to the party with the lower cost of care fails to provide the parties with incentives to be efficiently negligent. Instead, an optimal sharing rule should apportion damages so that each party bears a share of liability that is less than his or her cost of care in all those cases in which the court implements excessive care standards. Thus, Xavier's share of damages should be less than Yvonne's.

A sharing rule that apportions damages proportionally to relative fault - that is, the parties' relative departures from due care[10] - has the very important property of always implementing the optimal sharing. In the context of Example 2, Xavier's fault amounts to $30 because the court maintains that he should have taken care but he did not. Similarly, Yvonne's fault amounts to $90. Therefore, according to his relative fault, Xavier should pay

$\frac{30}{30+90} = 25\%$ of the damages, while Yvonne should bear the residual $\frac{90}{30+90} = 75\%$.[11]

With this apportionment, both parties have an incentive to be efficiently negligent: for Xavier being negligent and paying $25 is better than taking care at a cost of $30 and for Yvonne $75 is better than $90. This behaviour is also the socially desirable course of

[9] 567 So.2d 569 (La. 1990).

[10] Note that the notion of "relative fault" could be given a different interpretation: one could argue that the party with the lower costs of care is more at fault than the other party. We have discussed this case in footnotes 4 and 8 and accompanying text. One of the points we make in this paper is that this interpretation is misleading and that relative fault should be defined according to the parties' relative departures from due care.

[11] *Cf.* Barnes and Baeverstad (1982, p.284) using this apportionment rule to make a different point.

action. In our analysis below, we will demonstrate that this error-correction property of relative fault is not a feature of the example chosen but applies generally. Moreover, we will show that relative fault is the only sharing rule that generates incentives for the parties not to take due care whenever due care is socially undesirable and to take due care otherwise.

What happens if the court sets due care too low, holding a party non-negligent when in fact he or she should be held negligent? In this case, all negligence rules induce the same behaviour because they only differ with respect to the allocation of the accident loss between negligent parties. The effect of standards of care that are too lax is that parties will be found non-negligent too often. This effect falls outside the region in which the differences among rules matter (which is only when parties are found negligent). If due care standards are too low, all rules perform in the same way and hence our results are not reversed.[12] Therefore, our analysis applies generally to erroneous due-care standards and not only to excessive ones. (A similar argument explains why our findings also apply to the case when due care is too high for one party and too low for the other.) However, note that court assessments of the probability of accidents are made with hindsight and are more likely to be biased upwards rather than downwards.[13] Why should courts make errors with respect to the level of due care if they can correctly assess relative fault?

Example 3. The probability that an accident occurs can be reduced from 10% to zero if both Xavier (the injurer) and Yvonne (the victim) take care. Care taken by only one party has no effect. Care costs Xavier \$30 and Yvonne \$90. If an accident occurs, damages amount to \$1,000.

Like in the previous examples, the accident should not be prevented because the total costs of care \$30+\$90=\$120 are larger than the reduction in the expected accident loss 10% x \$1,000=\$100. Assume that the parties did not take care and an accident happened.

[12] Consider the following example: An accident can be prevented if both Xavier (the injurer) and Yvonne (the victim) spend \$40 on care. Care taken by only one party has no effect. If an accident occurs, damages amount to \$100. This is clearly an accident that should be prevented. However, if an accident occurs and the court erroneously concludes that the injurer's care cost was not justified (sets the due care level too low) and thereby finds the injurer non-negligent, parties will not have an incentive to take care. The injurer prefers spending nothing rather than taking care at the cost of \$40. In turn, since the injurer can be expected not to take care and the accident cannot be prevented unilaterally by the victim, she has no reason to take care. Note that this result does not depend on how the loss is shared if both parties act negligently. Therefore it is irrelevant which negligence rule is implemented.

[13] See Kamin and Rachlinski (1995) showing that, if people are asked to assess the probability of accidents after the fact, their estimates are lager if the accident has actually occurred.

The court has two tasks: assessing relative fault and setting the due-care standards. Assessing relative fault is relatively straightforward. The court needs to compare the cost of the parties' taken precautions (zero, in the context of the example) with the costs of taking due care. It should be stressed that relative fault does not need to be based on the socially-optimal due-care standards in order to perform its error-correction function. On the contrary, relative fault corrects court errors precisely because it is based on the court's (possibly erroneous) determination of due care.[14] Therefore, it is immaterial which levels of due care the court chooses.

In contrast, setting due care at the optimal level requires far more information. In addition to assessing the parties' costs of care, damages, and whether or not the parties took care - which are complex tasks - the court needs to estimate the ex ante probability of accidents. This might prove to be a formidable endeavour, because the probability of accidents is a function of the parties' behaviour. The court needs to calculate not only the ex ante probability of accidents given the parties' taken precautions (10%, in the example) but also the probability of accidents under any alternative behaviour. In order to do so, the court has to establish with some reliability a series of counterfactual claims about what would have happened had the parties behaved differently. In the context of Example 3, it has to be demonstrated that, if the injurer alone or the victim alone had taken care, the probability of accidents would have been 10% and that, if both parties had taken care, the probability of accidents would have been zero. Moreover, in most cases the magnitude of the damage is also a function of the parties' care and calculating damages that would have occurred under hypothetical alternative conditions is an exercise that falls into the realm of educated guesses, at best.

Therefore, a court is likely to make errors in the calculus of the optimal due-care standards but is nevertheless in the position of applying relative fault correctly, because the latter task requires much less information than the former. Regulatory agencies or governmental bodies involved in the setting of due-care standards typically face the same difficulties as courts, because they react to information about accidents that have already occurred and attempt to come to an assessment of possible alternative courses of events.

The parties often have superior knowledge about the effects of precaution on the probability and magnitude of losses because they were there at the time of the accident.[15]

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[14] Note that in fact in this case the optimal due-care standards are zero for both parties.

[15] See Shavell (1984, p. 359), explaining that when parties have superior knowledge about factors such as the benefit of the activity, the cost of reducing risk and the probability and magnitude of losses, liability

Even if this information is observable ex ante, it is often difficult to prove in court ex post. Hence, courts might incur in errors concerning the optimal due-care standards even when the parties do not make such errors. The case of *Li v. Yellow Cab Co.*[16] provides an example of a typical traffic accident context in which parties might have more information than courts on the optimal due care standards. When this is the case, comparative negligence implies the indirect use of information that would otherwise be lost. What if parties and courts make the same errors? In this case, all liability rules perform in the same way since the parties act as if the due-care standards set by the court were the efficient ones.[17] Our analysis emphasizes the advantages of comparative negligence when parties have more accurate information than courts and regulators (which may set due-care standards too high or too low) and remains valid when this is not the case (and hence all negligence rule perform in the same way).

In Section 2.2, we refer to existant literature on court errors and comparative negligence and explain why our approach differs from previous attempts to solve the puzzle of comparative negligence. In Section 2.3, we present a simple discrete model, in which parties can only choose whether they take care or not, but the costs of care are fixed. The discrete model illustrates the strategy and the results presented in a more general setting in Section 2.4. In Section 2.4.1, we present the setup of a general model with choices of care over a continuum. We analyse the behaviour of injurers and victims under erroneous standards and prove three results. We first show, in Section 2.4.2, that negligence in equilibrium is efficient. Any deviation from the due-care standards that emerges in equilibrium under any rule is efficient from the social welfare point of view because it yields less social costs of accidents than would occur if the parties abided by due care. Second, in Section 2.4.3 we show that comparative negligence is the rule that most frequently induces efficient negligence. Finally, in Section 2.4.4, we show that the

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should be preferred over regulation; otherwise, safety regulation is a better way of alleviating risks. Therefore, the context in which parties are better informed than courts and regulators coincides with the case in which liability is used, while the alternative scenario occurs when regulation in used and hence is not directly relevant for our analysis.

[16] 532 P.2d 1226 (Cal. 1975) See Grady (1998 p. 416) for a discussion of this case in the context of comparative negligence.

[17] If instead courts have superior information, the due-care standard should not be based on information that was not available to the parties ex ante, because the parties will not be able to predict the court decision. Thus, superior information by the court will in most cases not be used in trial (see Dari-Mattiacci and Garoupa (2009) and references therein). Hence, this case reduces to the case in which parties and courts have the same information. If instead regulators have superior information, then regulation of safety should be preferred over liability (Shavell 1984). Hence this case falls outside the scope of this paper, which focuses on tort liability.

commonly used rule that shares damages according to the parties' respective negligence always induces noncompliance whenever such an equilibrium can exist. In Section 2.5, we extend the analysis in several directions, including sequential care choices, errors in the assessment of the parties' costs of care, multiple tortfeasors, third-party externalities, and effects on the litigation rate. In Section 2.6, we conclude and emphasize the implications of our results.

2.2. Theories of sharing

Comparative negligence is both the most common rule in the US and in Europe[18] and a rule that law and economics scholarship has had enormous difficulties justifying.

Early studies suggested that comparative negligence, by splitting the loss between two negligent parties, could dilute incentives to take care as compared to simple and contributory negligence.[19] Later, it was shown that, under assumptions of complete information, all negligence rules produced the same (efficient) incentives to take care. Thus, the splitting of the loss between two negligent parties has no effect on the social cost of accidents.[20]. The allocative efficiency of all negligence rules poses the challenge to explain why comparative negligence is the most common rule. In fact, prima facie, comparative negligence seems to have a serious disadvantage compared to simpler all-or-nothing solutions: by introducing an additional layer of complexity into the trial, comparative negligence could increase the costs of litigation.[21] Scholars have proposed several theories of comparative negligence.[22] These will be discussed below.

2.2.1. To share or not to share

We first review theories that provide bases for some sharing of the loss between negligent parties and then move on to the question of how this sharing should be calculated in practice.

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[18] Curran (1992); Calabresi (1997 p. 2206); Best (2007); Robinette and Sherland (2003); van Dam (2006, pp. 334-335); Artigot I Golobardes and Gomez Pomar (2009, pp 48-52.

[19] Brown (1973); Posner (1977); *cf*. Posner (2010, p. 222) for a different view.

[20] Haddock and Curran (1995) are usually credited for what is known as the "allocative equivalence theorem" or the "efficiency equivalence theorem"; however, an earlier proof of the allocative equivalence of negligence rules can be found in Landes and Posner (1980, p. 539, fn. 51). See Jain and Singh (2002) for a general characterization of liability rules and Jain (2009) for an analysis of incremental liability rules.

[21] Posner (2010, p. 222); *cf* de Mot (2013) showing tht comparative negligence might result in lower litigation costs. We will examine litigation costs in section 2.5.5.

[22] See Bar-Gill and Ben-Shahar (2003) and Artigot I Golobardes and Gomez Pomar (2009) for two excellent surveys of the literature.

2.2.1.1. Fairness

If both parties are at fault, there is no reason why one of them should bear the full accident loss. Comparative negligence, by splitting the loss between two parties who are equally to blame for the accident, provides a more equitable solution than simple or contributory negligence.[23]

2.2.1.2. Insurance

Economic models of accidents are usually grounded in the simplifying assumption that there is a victim (who suffers a loss) and an injurer (who suffers no loss). In reality, however both parties could suffer some loss and the distribution of the harm between the parties may be a matter of chance. Consider, for instance, a collision at sea. A rule that completely bars recovery places a heavier burden on the vessel that suffers more damages; in contrast, a rule of comparative negligence that splits the total loss between both parties guarantees a more predictable and less risky outcome and therefore insures parties against (some of) the risks deriving from accidents (Posner, 2010, p. 223).

2.2.1.3. Lapses into negligence.

In the real world parties may fail to play equilibrium strategies and it may occasionally occur that a party either lapses into negligence[24] or for other reasons chooses not to take care even when the game-theoretic model of accidents predicts that both parties should take care. It has been argued that in these situations comparative negligence could save the day by creating some incentives to take care to a party that observes or expects the other to behave negligently.[25]. Although appealing, the correction-of-lapses theory explains too much. If the victim is expected to lapse into negligence the strongest incentives for the injurer are provided by simple negligence, not by comparative negligence. Similarly, if the injurer can be expected to lapse into negligence, the strongest incentives for the victim are provided by contributory negligence. If both parties can be expected to lapse into negligence, it is not clear whether a rule that produces some incentives for both parties

[23] See Cooter and Ulen (1986), Bar-Gill and Ben-Shahar (2003) and Dari-Mattiacci and de Geest (2005) for references.

[24] See Grady (1990) and further Grady (1998) on lapses and their relation to comparative negligence, see further section 2.6.

[25] See Orr (1991) and, for a critique, Chung (1993), p. 404 "there is no efficiency motivation for favouring one rule over the other".

(comparative negligence) is to be preferred to rules that produce full incentives for one party only (simple and contributory negligence), or vice versa.[26]

2.2.1.4. Least-cost avoidance

Orr (1991) claimed that a dilution of incentives can be beneficial if accidents are of the alternative-care type: one party's care is enough to prevent the accident. Then, a properly engineered comparative negligence rule can induce only one party to take care (which is efficient) while contributory negligence could induce both parties to take care. Chung (1993) later showed that this result derived from an implicit assumption concerning the erroneous determination of the negligence standard. If one party's care is enough to prevent the accident, then the negligence standard should concern that party only, while the other party should be considered non-negligent by definition, irrespective of whether he or she took care. Therefore, efficiency can be realized by imposing liability on one party only rather than imposing liability on both parties and then splitting the loss in such a way that incentives for one of them are too low to take care.

2.2.1.5. Filtering-out the most harmful accidents

More recently, and after the publication of Bar-Gill and Ben-Shahar (2003), a critical appraisal of extant theories of comparative negligence, Dari-Mattiacci and de Geest (2005) have tackled this puzzle anew. They propose a law-enforcement model in which precaution by one party is enough to avoid the accident, choices are binary (violate or comply) and the enforcer is incompletely informed about the parties' precaution costs. The analysis shows that comparative negligence has a filtering effect: it prevents accidents that yield high social costs, but lets accidents that yield low social costs occur. Rules that burden one party, such as simple or contributory negligence, also prevent some accidents while letting other accidents occur, but they do so at random, without any selection. Therefore, comparative negligence improves social welfare by filtering out the most harmful accidents. This analysis, however, is limited to a discrete model of unilateral (only one party can take care at reasonable costs) or alternative care (both parties can take care at reasonable cost but one of them is the least-cost avoider).

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[26] The theory that we present in the following relates to lapses in a specific way. We do not address the strategic problem of corrective sequential care discussed above. Rather lapses are relevant to out theory insofar as the presence of lapses is known to the parties but is difficult to verify in court; that is, parties are aware of the possibility of lapses but the court is not. If this is the case, courts might make errors in setting the due-care standards while parties know the socially optimal levels of care. To the extent that lapses can be rationalized as a determinant of court errors our theory applies to lapses.

2.2.1.6. Evidentiary uncertainty

Cooter and Ulen (1986) analysed the functioning of tort liability under evidentiary uncertainty, when parties cannot accurately predict whether the court will find them negligent. Evidentiary uncertainty induces parties to alter their levels of precaution. Cooter and Ulen found that, when parties are symmetrical in their abilities to take precautions, comparative negligence is to be preferred because it generates moderate distortions by both parties, while simple and contributory negligence cause large distortions for one party and small distortions for the other.[27] Bar-Gill and Ben-Shahar (2003) emphasize that this result relies on the hypothesis that moderate distortions are preferable to large ones, which needs not be true in general. In addition, they show that moderate distortions could also be obtained by all-or-nothing rules.

2.2.1.7. Self-selection

Rubinfeld (1987) proposed a setting in which there is heterogeneity among parties with respect to their costs of care, which cannot be directly observed in court. He finds it optimal for the court to set very high standards - in order to induce parties to be negligent - and employ comparative negligence - in order to induce parties to self-select with respect to their costs of care. The mechanism works because the parties can make small adjustments in their share of liability by taking more or less care. In contrast, under simple or contributory negligence, liability jumps discontinuously from zero to full liability, and adjustments in care are not fine-tuned. Bar-Gill and Ben-Shahar (2003) build on Rubinfeld's analysis and show that information revelation mechanisms can be constructed in response to a broader set of problems and that they can be implemented in all negligence rules, not only under comparative negligence. For instance, if the victim has more information about the harm than the injurer or the court, then a rule that sets damages equal to the expected harm allows victims to self-select irrespective of the negligence rule. Therefore, if the problem is that courts do not have precise information on the parties' idiosyncratic characteristics, the solution is not necessarily comparative negligence.

2.2.1.8. Our point: cooperation-mimicking sharing

In this paper, we claim that comparative negligence can serve as a buffer against erroneous due-care standards. Our argument is grounded in the idea that all-or-nothing

[27] See also Edlin (1994) submitting that, under evidentiary uncertainty, due-care standards should be more lenient under contributory negligence than under comparative negligence. In our analysis, we assume that the due-care standards are given, so that they are not instrumental towards achieving efficiency.

rules (simple and contributory negligence) employ a stick (the payment of damages), which is applied entirely to one party. In contrast, comparative negligence shares this stick between negligent parties. Dari-Mattiacci and de Geest (2010) show that all-or-nothing sticks can be used to extract more effort from noncooperative parties than the amount of the stick itself, that is, sticks have a multiplication effect; the threat to punish is first applied entirely to one party and, if that party complies, it can be again entirely applied to the other party. Translated into an accident setting, this means that all-or-nothing rules can result in both parties taking care (for instance, \$60+\$60) in excess of the accident loss that care prevents (for instance \$100). The multiplication effect can be countered by rules that share the stick between the parties. Sharing works as an implicit cooperation device. If parties could cooperate, they would agree to be negligent and share the loss between them (say, each party could pay \$50). A rule that shares the loss between them (say, 50%) imperfectly mimics this cooperative agreement. In this paper, we draw on the multiplication principle in order to explain that, if the due-care standards are erroneously set, comparative negligence induces the parties to violate them and choose levels of precautions that advance social welfare.

Our analysis differs from Cooter and Ulen's analysis in that we do not make any assumption about the size and effect of distortions in the care levels; moreover, we consider erroneous but certain standards, rather than uncertain standards as Cooter and Ulen do.[28] To be sure, we do not downplay the importance of evidentiary uncertainty; rather we think that it affects all rules in a similar way (Bar-Gill and Ben-Shahar 2003).

Differently from Rubinfeld (1987), due-care standards in our model are erroneous not because there is heterogeneity in the population of injurers and victims, but rather because the court (or the regulator) makes mistakes in calculating the ex ante probability of accidents as a function of the parties' care levels. As a result, the due-care levels might be set too high or too low. There is a fundamental difference between information on the parties' idiosyncratic characteristics and information about the probability of accidents. The parties' idiosyncratic characteristics may be difficult to ascertain with certainty but concern factors that pertain to the accident that *has happened*; for instance, they relate to the costs

[28] In a recent paper, Stremitzer and Tabbach (2009) also study the case of erroneous due-care standards in a setting different from ours; in their setting, precaution is unilateral, there is insolvency, and liability is proportional to the probability that the harm was caused by the injurer's negligence. Leshem and Miller (2009) investigate the performance of all-or-nothing rules versus damages proportionate to the degree of uncertainty in the defendant's liability. In their paper erroneous due-care standards play no role and precaution is unilateral.

of the parties' care or the magnitude of the harm. In contrast, information on the probability of accidents or, more precisely, to the mapping between the parties' many possible care choices and the probability (and, possibly, magnitude) of accidental harm concerns all the possible accidents that could have happened but, in fact, *have not happened*.

Hence, if there is a problem with respect to the courts' inability to gather all relevant information, this problem is likely to be more serious when it comes to estimating the probability of accidents.[29] While lack of information on the parties' idiosyncratic characteristics may provide an argument in favour of any negligence rule, we show that lack of information about the probability of accidents casts an unambiguous vote for comparative negligence. Our proposal can be implemented by courts irrespective of a court's awareness that some information is lacking. The correction of errors made in setting due care is not a deliberate activity. Rather, relative fault can be easily implemented in all cases and it will make a difference only in those cases in which due-care standards are too high.

2.2.2. How to share

A theory of comparative negligence should also provide guidance as to how to share the damage between the parties. Fairness and insurance theories offer easily implementable solutions. Prima facie, a 50% sharing is the preferred rule,[30] unless more information is available and a different sharing seems more appropriate. The filtering theory offers a simple recipe for a subset of cases (unilateral care with symmetric distribution of the costs of care): sharing should be equal to the probability that each party can avoid the accident. However, a more complex sharing is required in general.[31]All other theories offer little guidance as to how the court should pinpoint the optimal sharing of the loss between the parties, because the optimal sharing rule is a function of the specifics of the situation.[32]

Showing that *an* optimal sharing of the loss is preferred to the all-or-nothing allocations does not imply that *any* sharing of the loss is better than the all-or-nothing

[29] Haddock and Curran (1995, pp. 63-64) discuss a number of errors that the parties or the court could make, including errors concerning the probability of accidents, but conclude that to offset these errors courts would have to first understand the nature and the magnitude of the error and this is unlikely to happen. Therefore, no negligence rule is likely to be unambiguously superior. Our proposal does not require the court to assess the magnitude of errors.

[30] For instance, Posner (2010, p. 223).

[31] Dari-Mattiacci and de Geest (2005, p. 217).

[32] See Orr 1991 and Cooter and Ulen (1986, p. 1092). Rubinfeld (1987, pp. 390-391) provides an example with a linear sharing rule based on a fixed sharing of the loss but does not expand on how a court could determine the exact sharing and what information this task requires.

allocations. Thus, if courts are not able or lack the information necessary to implement the optimal sharing, social costs may rise rather than decrease as a result of the introduction of comparative negligence. Therefore, a theory of comparative negligence based on the courts' lack of information concerning some crucial variables of the model should not rely on a sharing rule that, to implement, requires precisely the information that courts lack. Overly complex sharing rules or sharing rules that improve incentives only if finely tuned are unlikely to do the job. In contrast, the rule that we support, relative fault, can be implemented with information the court has and it requires less information than the determination of negligence.

Case law and statutes contemplate various forms of sharing. Pure comparative negligence shares the loss according to each party's percentage of negligence; a modified form of comparative negligence bars recovery if the plaintiff's relative negligence exceeds a certain threshold (49% in some jurisdictions and 50% in other jurisdictions); finally, "slight-gross" comparative negligence bars recovery unless the plaintiff's negligence is slight and the defendant's negligence is gross.[33] However, the law is not very clear about how these percentages should be measured and what relative negligence means. Different interpretations have been proposed, that underscore the importance of such factors as the relative degrees of fault, the relative degrees of causal contribution to the accident, and the characteristics of the parties and their conduct.[34] The rule we propose, relative fault, shares the loss exclusively according to the parties' relative departures from due care.

2.3. An illustration of the results

Consider a simple scenario in which care involves a discrete choice. An accident can be prevented if the injurer and the victim spend fixed amounts X and Y, respectively, on care. If either or both of them fail to take care, an accident L will occur with probability P. The accident should be prevented if $X + Y < PL$; otherwise the parties should not take care. An ideal liability rule should hold a party negligent for not taking care only in the former case.

[33] *McIntyre v. Balentine*, 833 S.W.2d 52 (Tenn. 1992). See Grehan (1981), Barnes and Baeverstad (1982), Cooter and Ulen (1986, pp. 1074-1079) and Artigot I Golobardes and Gomez Pomar (2009, pp. 52-53).

[34] *Stanford v. Chevrolet Division of General Motors*, 642 P.2d 624 (or. 1982); *Watson v. State Farm Fire & Cas. Ins. Co.*, 469 So. 2d 967 (La. 1985); Restatement (third) of Torts: Apportionment of Liability §8 (2000). See also Prosser (1953, p. 481), Parisi and Fon (2004) and Edelman (2007) (distinguishing between absolute negligence and relative negligence; what we call relative fault corresponds to absolute negligence in Edelman's terminology).

While the parties have complete information, the court can only perfectly verify X, Y and L, but makes mistakes in assessing P, which the parties anticipate. As a result, the court's probability estimate $\tilde{P}$ might be greater or less than the real P. There are cases in which $\tilde{P} > \frac{X+Y}{L} \geq P$, meaning the court determines that care should have been taken (and failure to do so amounts to negligent behaviour) while in fact this is not the case. In other cases, the court might underestimate the probability of accidents $\tilde{P} \leq \frac{X+Y}{L} < P$ and erroneously conclude that care should not have been taken. We will examine the ex ante incentive effect of court errors under simple, contributory and comparative negligence. (These results can be easily extended to strict liability rules). As illustrated in Figure 1, these rules only differ with respect to the apportionment of damages between negligent parties: $\sigma = 1$ (simple negligence), $\sigma = 0$ (contributory negligence) or $0 < \sigma < 1$ (comparative negligence).[35]

Figure 1. Apportionment of damages under negligence rules

	Injurer negligent	Injurer non-negligent
Victim non-negligent	Injurer	Victim
Victim negligent	Injurer's share σ Victim's share $1 - \sigma$	Victim

If the court assesses $\tilde{P} \leq \frac{X+Y}{L}$, parties are non-negligent by definition because failure to take care does not amount to negligent behaviour in the eyes of the court. This generates incentives for both parties not to take care irrespective of the chosen negligence rule, whether or not care would be socially desirable. (The injurer does not take care because he bears no loss; in turn the victim does not take care because she cannot prevent the accident unilaterally.) If instead the court assesses $\tilde{P} > \frac{X+Y}{L}$, parties will be found negligent if they did not take care and the game has the form depicted in Figure 2. If this is a case in which the accident should be prevented, $P > \frac{X+Y}{L}$, the due-care standards set by the court are

[35] Note that if $\tilde{P} \leq \frac{X+Y}{L}$ the parties will be found non-negligent by the court regardless of whether they took care. Hence, an accident may occur even if both parties are non-negligent in the eyes of the court and the loss will be borne by the victim. In contrast, if $\tilde{P} > \frac{X+Y}{L}$ the court will find the parties non-negligent only if they took care. Hence, if both parties are non-negligent there will be no accident and hence no damage to bear.

socially optimal and it follows from the well-known efficiency equivalence theorem[36] that the game has a unique Nash equilibrium where both parties take care under all negligence rules.

Figure 2. The parties' expected costs under negligence rules

	Injurer negligent	Injurer non-negligent
Victim non-negligent	Y PL	Y X
Victim negligent	$(1-\sigma)PL$ σPL	PL X

The interesting case arises when the court erroneously assesses the probability of accidents to be so high that care is deemed justified, while in fact care is not socially desirable ($\tilde{P} > \frac{X+Y}{L} \geq P$). In this case, the superiority of comparative negligence originates in the combination of two factors: efficient negligence and relative fault. If negligence emerges in equilibrium, then it is "efficient negligence" (a result that echoes Grady, 1998). Suppose that the outcome in which both parties are negligent is an equilibrium. This can be the case only if both parties prefer being negligent rather than unilaterally non-negligent ($\sigma PL < X$and $(1-\sigma)PL < Y$), which implies that the sum of the parties' care expenditures is larger than the the sum of the parties' shares of expected damages, that is, of the total expected damages ($PL = \sigma PL + (1-\sigma)PL < X + Y$). In turn, this shows that being negligent is socially desirable and thus, that negligence is efficient.[37]

If negligence is efficient whenever it emerges in equilibrium, then a negligence rule that maximizes the chance of efficient negligence is to be preferred to other rules. A comparative negligence rule that apportions damages according to relative fault is such a rule. First assume that care is socially undesirable: $X + Y > PL$. The goal is to induce both parties to be negligent. Multiplying both sides of the last inequality by X and rearranging the terms, we obtain $X > \frac{X}{X+Y}PL$. This shows that if damages are apportioned according to relative fault ($\sigma = \frac{X}{X+Y}$) the injurer can be induced not to take care (and be negligent in the eyes of the court) whenever care is not socially efficient. (The same applies to the victim). Therefore, relative fault has the property of inducing efficient negligence. Substituting the inequality with a strict equality, one sees that relative fault is the only rule with this

[36] See footnote 20 above and accompanying text.
[37] In the next section we show that this result applies generally, hence also to unilateral negligence.

property. Simple and contributory negligence (along with comparative negligence rules based on other methods of apportioning damages) fail because they apply too much liability pressure on one party and too little on the other, as shown numerically in Example 2. In contrast, relative fault guarantees that the liability pressure is dosed optimally, so that both parties have enough incentives to be (efficiently) negligent.[38]

2.4. Formal analysis

Here, we consider the standard model of accidents. Accidents occur between two wealth-maximizing, risk-neutral parties: a victim and an injurer. Both the injurer and the victim can take care ($x \geq 0 \; and \; y \geq 0$, respectively) in order to reduce a monetary expected harm. The expected harm depends on both care levels and is expressed by $l(x, y) > 0$, which is assumed to be strictly convex in x and y, with $l_x(x, y) < 0$ and $l_y(x, y) < 0$.

2.4.1. Setup and efficiency equivalence

Two standards of due care, x^d and y^d are set by the court or a regulator. We examine three negligence rules: simple negligence, contributory negligence and comparative negligence. (The analysis of strict liability rules is analogous). If both parties abide by the due-care standards, the victim bears the harm. If one party abides by the due-care standard, while the other is negligent, the negligent party bears the harm. Finally, if neither party complies with due care the injurer pays a share σ of the damages and the victim bears the remaining portion, $1 - \sigma$. We have simple negligence if $\sigma = 1$: the injurer pays damages if he is negligent, irrespective of the behaviour of the victim. We have contributory negligence in the opposite case of $\sigma = 0$: the injurer pays damages if negligent, but if the victim is also negligent the injurer's liability is waved. Finally, we have comparative negligence if $0 < \sigma < 1$, implying that if both parties are negligent, each of them bears a portion of the damages.

Figure 3 shows the expected costs to be paid by the injurer and the victim respectively, under all three rules. Under all rules, damages awarded to the victim are assumed to be perfectly compensatory, that is, equal to the harm suffered.

[38] Technical details about the equilibria of this game are provided in Appendix 2.1 Solution of the discrete game.

Figure 3. The parties' expected costs under negligence rules

	$x < x^d$	$x \geq x^d$
$y \geq y^d$	Y PL	Y X
$y < y^d$	$(1-\sigma)PL$ σPL	PL X

As is common in the literature, we take the social cost to be the sum of the costs of care and the expected damage. The socially optimal levels of care are the levels of x and y that minimize this sum. Let x^s and y^s denote the care levels that minimize the social cost of accidents:

[1] $S(x,y) = l(x,y) + x + y$

Assuming that x^s and y^s are positive, these socially optimal care levels are implicitly defined by the following first order conditions (subscripts indicate derivatives):

[2] $l_x(x^s, y^s) = -1$

[3] $l_y(x^s, y^s) = -1$

If the regulator sets due care equal to the socially optimal levels ($x^d = x^s$, and $y^d = y^s$), the game has a unique Nash equilibrium, where both the injurer and the victim take due care ($x = x^d$, and $y = y^d$). Landes and Posner (1980, p. 539, fn. 51) and Haddock and Curran (1995, Sec. III) have demonstrated that this result holds under all three rules considered, that is, irrespective of the sharing σ. Rea (1987, Prop. 2) has shown that this result also holds true for $\sigma = \sigma(x,y)$, that is, a sharing of the loss which is endogenously determined by the levels of care chosen by the parties. It follows that all rules are equivalently efficient. For ease of exposition, in the next section we first examine an exogenously given σ and later extend the analysis to an endogenously determined $\sigma(x,y)$.

We now consider a situation in which the regulator erroneously sets due care too high or too low from a social welfare point of view. Due care can be erroneously set for different reasons. The regulator might inaccurately assess the relevant costs and benefits, the courts might be biased, the parties might erroneously interpret the legal standard, or, as we have emphasized in the previous sections, the court or the regulator may lack relevant information on the probability of accidents. We assume that the parties are informed about the standards of due care set by the regulator or can predict the standards of due case as will be set by the court. As we have done in Section 2.3, our strategy is to first show that negligence efficiently emerges in equilibrium and then to show that comparative

negligence with relative fault is the negligence rule that facilitates efficient negligence the most.

2.4.2. Equilibrium deviations from due care are efficient

If the level of due care is different from the socially optimal level, the parties might take levels of care ($x^* \neq x^d, y^* \neq y^d$), which are privately optimal for the parties but different from the due-care standards. The first question that arises is whether such deviations from due care reduce the social cost of accidents or not. We focus on pure-strategy Nash equilibria.[39] The following Lemma shows that if the parties deviate in equilibrium from the due-care standards, the resulting social cost of accidents is less than it would have been had they abided by the due-care standards.

Lemma 1. If due care is too high or too low, any equilibrium in which one or both parties deviate ($x^* \neq x^d$) and/or ($y^* \neq y^d$) yields less social cost than would result if both parties took due care:$S(x^*, y^*) \leq S(x^d, y^d)$.

The intuition behind this result is that negligence rules are such that the party who decides to deviate internalizes all costs and benefits of his decision and hence his decision to deviate must be socially advantageous. This result implies that negligence efficiently emerges in equilibrium and thus should be somewhat encouraged. The following proposition shows that, since negligence efficiently emerges in equilibrium, if there are two equilibria, one of which is a compliance equilibrium and one a noncompliance equilibrium, then the latter is preferable because it yields lower social costs.

Proposition 1. If there are two equilibria, one in which both parties are non-negligent, ($x^{**} \geq x^d, y^{**} \geq y^d$)and one in which both parties are negligent, ($x^* < x^d, y^* < y^d$), then the latter yields less social costs of accidents: $S(x^*, y^*) < S(x^{**}, y^{**})$.

Corollary 1. If the outcome in which both parties are non-negligent is an equilibrium ($x^{**} \geq x^d, y^{**} \geq y^d$), an outcome in which one party is negligent and the other is non-negligent, ($x^* = x^d, y^* < y^d$)or ($x^* < x^d, y^* = y^d$) cannot be an equilibrium.

[39] Mixed-strategy equilibria are unstable.

Proposition 1 shows that whenever negligence emerges in equilibrium, it is also desirable from a social point of view. Corollary 1 generalizes the results of Proposition 1 by excluding the possibility that other equilibria arise.

2.4.3. Comparative negligence stimulates efficient negligence

Since equilibrium deviations away from due care are always socially efficient, a liability rule that stimulates equilibrium deviations reduces the total social cost of accidents. The core of our argument is that comparative negligence is the rule that stimulates efficient deviations most frequently. We will examine several different cases and conclude that comparative negligence is either equivalent or superior to rules that burden one party only, such as simple negligence or contributory negligence.

Proposition 2. If compliance is an equilibrium, comparative negligence yields lower social costs than simple and contributory negligence; if compliance is not an equilibrium, negligence rules cannot be generally compared.

2.4.3.1. Case 1: Compliance is an equilibrium

If there is an equilibrium in which both parties take at least due care, then there cannot be a second equilibrium in which one party violates and the other complies (Corollary 1). This situation occurs for values of the due-care standards that are sufficiently close to the socially optimal levels. The only remaining possibility is a second equilibrium in which both parties are negligent $(x^* < x^d, y^* < y^d)$. Proposition 1 shows that if such an equilibrium exists then it is also desirable from a social point of view.

A negligence equilibrium arises if both parties find it more convenient to bear a share of the damages than to abide by the due-care standard. Therefore, the injurer's share of damages should be high enough to prevent him from complying but not so high that the remaining victim's share falls below her compliance costs. The balance of the injurer's and victim's incentives to be negligent gives a range of possible values of the sharing σ that support the efficient negligence equilibrium:

$$[4] \qquad 1 - \frac{y^d - y^*}{l(x^*, y^*)} \leq \sigma \leq \frac{x^d - x^*}{l(x^*, y^*)}$$

An equilibrium in which both parties are negligent exists if and only if there is at least one value of σ that satisfies equation [4]. It follows that the condition in equation [4] is necessary and sufficient for the existence of a negligence equilibrium. An optimal sharing

rule is therefore one that implements a sharing σ such that it falls within this range of values. It is easy to see that rules that always implement $\sigma = 0$ (simple negligence) or $\sigma = 1$ (contributory negligence) are not very likely to fall within the range, and hence often forgo the possibility to induce a socially desirable equilibrium. In contrast, comparative negligence could be designed in such a way as to implement an appropriate value of σ within the range.

2.4.3.2. Case 2: Compliance is not an equilibrium

In contrast with the previous case, here we consider the case in which compliance by both parties is not an equilibrium. This situation occurs for values of the due-care standards that are sufficiently greater than the socially optimal levels. We make a distinction between two subcases:

1) Negligence by both parties cannot be an equilibrium. Here we consider the subcase in which due care is such that the there is no σ that satisfies equation [4]. Then there cannot be an equilibrium in which both parties are negligent, irrespective of the liability rule in force. Since the emergence of equilibria in which one party is negligent and the other is non-negligent does not depend on the sharing between negligent parties, the choice between comparative negligence and other rules does not affect the social loss.

2) Negligence by both parties could be an equilibrium. Here we consider the subcase in which due-care standards are such that there exists a σ that satisfies equation [4], so that negligence by both parties could be an equilibrium. By hypothesis, compliance by both parties is not an equilibrium. There remain two other possible equilibria: one in which the injurer is negligent while the victim is non-negligent and another in which the injurer is non-negligent while the victim is negligent. Which one of these three possible equilibria is desirable from society's point of view depends on the levels of x^d and y^d and on the characteristics of the expected harm $l(x, y)$, so that under different configurations a different rule could be desirable.

Summing up, in case 1 (non-negligence is an equilibrium) comparative negligence can be designed so that it performs better than other rules, while in case 2 (non-negligence is not an equilibrium) the different rules cannot be generally compared.

Proposition 2 describes a situation in which comparative negligence can induce more efficient care than alternative rules by allowing the parties to “correct” erroneously high standards of due care and take less but more efficient care. As Proposition 2 shows, this is

the case when two equilibria can coexist: an equilibrium in which both parties comply and an equilibrium in which both parties violate the standards of due care.

2.4.4. Apportioning damages according to relative fault

So far, we have considered a sharing rule σ that is exogenously determined and announced ex ante to the parties. Even though it is possible to determine the optimal exogenous sharing rule, in practice this is unlikely to happen. The problem with an exogenous σ is that a regulator who makes mistakes in determining the due-care standards cannot be expected to set the sharing of the accident loss in an optimal way, so that parties can efficiently deviate from the due-care standards (although, in general, some intermediate levels of σ might still prove more efficient than simple or contributory negligence).

Most commonly, the apportionment of the loss is done ex post in court, on the basis of an (ex ante determined) balance of the parties' respective negligence. This makes the sharing endogenous to the model ($\sigma = \sigma(x, y)$), with the natural assumptions that $\sigma_x(x, y) < 0$ and $\sigma_y(x, y) > 0$ (if a party raises his level of care, his share in the damages decreases). As we have already noted, the determination of the social optimum and the efficiency equivalence result in Section 2.4.1 also hold true with an endogenous sharing rule. Likewise, the analysis in Section 2.4.2, which shows that deviations from due care are efficient when they arise in equilibrium, does not change with an endogenous sharing rule, thus all our results (Lemma 1, Proposition 1, and Corollary 1) remain valid.

The analysis of Section 2.4.3 can be easily adapted to an endogenous sharing rule by modifying the relevant range in equation [4] as follows:

$$[5] \qquad 1 - \frac{y^d - y^*}{l(x^*, y^*)} \leq \sigma(x^*, y^*) \leq \frac{x^d - x^*}{l(x^*, y^*)}$$

Proposition 2 implies that if an equilibrium (x^*, y^*) exists, in which both parties violate the due-care standards, and if the resulting apportionment of the loss falls in the range equation [5], then comparative negligence yields lower social costs than simple and comparative negligence. In turn, an equilibrium (x^*, y^*) exists if there are values of the parties' care $x^* \in [0, x^d)$ and $y^* \in [0, y^d)$, such that

$$x^* = \arg min\,[\sigma(x, y^*) l(x, y^*) + x]$$
$$y^* = \arg min\,[(1 - \sigma(x^*, y)) l(x^*, y) + y]$$

In this section, we examine the simplest and most intuitive endogenous comparative negligence rule, which shares the loss according to the parties' relative fault[40]:

[6] $\sigma^*(x,y) \equiv \frac{x^d - x}{(x^d - x)+(y^d - y)}$

Proposition 3. The sharing rule $\sigma^*(x,y)$ (relative fault) equal to the parties relative departures from due care is the only sharing rule that always falls within the optimal range given in equation [5] whenever negligence by both parties can be an equilibrium.

The intuition behind this result is that relative fault apportions liability depending on the parties cost of taken care and on their outside options (taking due care). By doing so, relative fault balances the incentives of victim and injurer so that both parties prefer to be negligent when this is socially desirable due to excessive due-care standards.

2.4.5. A numerical example

Here we present a numerical example illustrating the main results obtained above. In this example, we compare comparative negligence with simple and contributory negligence - an analogous example can be constructed to discuss strict liability rules. Consider the following simple function for the expected accident loss:

$$l(x,y) = 100 - ax^{\frac{1}{a}}y^{\frac{1}{a}} > 0$$

with $a > 2$. Note that the parties' precautions are complements ($l_{xy} < 0$).[41] The social welfare function is

$$S(x,y) = 100 - ax^{\frac{1}{a}}y^{\frac{1}{a}} + x + y$$

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[40] See Artigot I Golobardes and Gomez Pomar (2009, pp. 52-53) for a classification of the possible sharing rules under comparative negligence. Note that this sharing rule has the desired properties: $\sigma_x^*(x,y) < 0$, $\sigma_y^*(x,y) > 0$, $\sigma_{xx}^*(x,y) > 0$ and $\sigma_{yy}^*(x,y) < 0$. This implies that the second order conditions for a minimum are satisfied for both parties:

$$\sigma_{xx}^*(x,y)l(x,y) + 2\sigma_x^*(x,y)l_x(x,y) + \sigma^*(x,y)l_{xx}(x,y) > 0$$
$$-\sigma_{yy}^*(x,y)l(x,y) - 2\sigma_y^*(x,y)l_y(x,y) + (1-\sigma^*(x,y))l_{yy}(x,y). > 0$$

[41] This function has the desired properties: $l_x(x,y) = -x^{\frac{1-a}{a}}y^{\frac{1}{a}} < 0, l_y(x,y) = -x^{\frac{1}{a}}y^{\frac{1-a}{a}} < 0, l_{xx}(x,y) = \frac{a-1}{a}x^{\frac{1-2a}{a}}y^{\frac{1}{a}} > 0, l_{yy}(x,y) = \frac{a-1}{a}x^{\frac{1}{a}}y^{\frac{1-2a}{a}} > 0,$ and $l_{xy}(x,y) = -\frac{1}{a}x^{\frac{1-a}{a}}y^{\frac{1-a}{a}} < 0.$

The necessary condition for a minimum $(l_{xx}(x,y)\, l_{yy}(x,y) > (\, l_{xy}(x,y))^2$ is $(\frac{a-1}{a})^2 x^{\frac{2-2a}{a}}y^{\frac{2-2a}{a}} > (\frac{1}{a})^2 x^{\frac{2-2a}{a}}y^{\frac{2-2a}{a}}$ which is satisfied because $a - 1 > 1$. The partial derivatives are not defined at $x = 0$ or y= 0 (or both, for the cross partial derivative). For the first derivatives, the singularity can be removed by defining $l_x(0,y) \equiv \lim_{x\downarrow 0} l_x\,(x,y)$ and $l_x(x,0) \equiv \lim_{y\downarrow 0} l_y\,(x,y)$. Given that the second and cross-partial derivatives are well-defined in any neighbourhood of 0, this does not create problems for the validity of the internal solutions.

and it is easy to see that the socially optimal levels of care are $x^s = y^s = 1$ (for any value of a).[42]

Now assume that the parameter is $a = 2.1$ and that both standards of due care are set at an excessively high level, say $x^d = 6$ and $y^d = 4$. Both parties will be induced to comply (compliance is an equilibrium). Under the rules we consider in this example, the victim bears the full accident loss and his cost of care if the injurer is non-negligent, irrespective of his own level of care. Given that the injurer complies, the victim's cost is $100 - a(x^d)^{\frac{1}{a}}y^{\frac{1}{a}} + y$, which is minimized by $y^{**} = 5.09 > y^d$ (all values are approximated); thus, the victim does not have an incentive to deviate. In turn, the injurer complies because his cost while complying is less that the cost he would bear if he did not comply: $x^d < 100 - ax^{\frac{1}{a}}y^{**\frac{1}{a}} + x$, for all $x < x^d$. The right-hand side of this inequality is minimized by $x^* = 4.39$ and is at least equal to $95.16 > x^d$; therefore, the injurer does not have an incentive to deviate. It can be easily verified that there is no other equilibrium in this game;[43] thus, the excessive due-care standards will inevitably result in excessive care by both parties (the victim takes even more care than the due level). The total social cost with compliance is $S(x^d, y^{**} > y^d) = 100.39$, which is larger than the social cost at the socially optimal levels of care, $S(x^S, y^S) = 99.90$.

Let us now consider the more extreme case in which the standards of due care are set at an even higher level: $x^d = 60$ and $y^d = 40$. Again, there is a compliance equilibrium in which both parties take at least due care. Similar to the previous case, the victim complies because his cost (if the injurer takes $x^d = 60$ is minimized by $y^{**} = 41.35 > y^d$. Likewise, the injurer complies because the due-care standard is less than the cost of unilateral noncompliance:$x^d < 100 - a(x^*)^{\frac{1}{a}}(y^{**})^{\frac{1}{a}} + x^* = 67.57$, with $x^* = 29.48$. The social loss due to the excessive due-care standards is even larger now, with a total cost of accidents reaching $S(x^d, y^{**} > y^d) = 140.51$.

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[42] The first-order conditions are $x^{\frac{1-a}{a}}y^{\frac{1}{a}} = 1 = x^{\frac{1}{a}}y^{\frac{1-a}{a}}$, which yields the result.

[43] The two equilibria in which a party is unilaterally negligent are ruled out by the Corollary. The case in which both parties are negligent can be ruled out by noting that a necessary condition for this equilibrium is $x^d + y^d > S(x^*, y^*) \geq S(x^S, y^S)$. This condition derives from summing up the inequalities in equations [7] and [8]. However, note that $10 = x^d + y^d < S(x^S, y^S) = 99.90$. Thus, the outcome in which both parties are negligent cannot be an equilibrium.

Under simple negligence and contributory negligence, the compliance equilibrium is the only equilibrium of this game.[44] However, under a comparative negligence rule with $\sigma = 60\%$, there is an equilibrium in which both parties violate the (excessive) standards of due care and take very low levels of care:[45] $x^* = 4.10^{-7}$ and $y^* = 3.10^{-7}$.

This is an equilibrium because $x^d > \sigma[100 - a(x^*)^{\frac{1}{a}}(y^*)^{\frac{1}{a}}] + x^* = 59.99$ and $y^d > (1-\sigma)[100 - a(x^*)^{\frac{1}{a}}(y^*)^{\frac{1}{a}}] + y^* = 39.99$. Most importantly, this equilibrium, in which both parties violate the standards of due care, yields less social costs than the compliance equilibrium, $S(x^*, y^*) = 99.99 < 114.51$; although this is not the socially optimal level, it is close to it.

The problem with a comparative negligence rule is that the sharing rule is crucial in order to obtain a welfare-enhancing noncompliance equilibrium. Therefore, let us now consider the case in which the sharing of the loss between negligent parties is endogenously determined as a function of the parties' relative negligence; that is, the sharing is $\sigma^*(x, y)$ as in equation[6]. There is a unique Nash equilibrium in which both parties violate the due-care standards. The levels of care chosen by the parties are $\tilde{x} = 0.98$ and $\tilde{y} = 0.98$. These levels of care induce a sharing which is approximately $\sigma^*(\tilde{x}, \tilde{y}) = 60\%$,[46] that is, close to the sharing considered above. Note, however, that with an endogenous sharing the parties' levels of care are very close to the socially optimal levels. This is due to the fact that an endogenous sharing rule improves the incentives of the

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[44] The two equilibria in which a party is unilaterally negligent are ruled out by the Corollary. The case in which both parties are negligent can be ruled out as follows. Under simple negligence, if both parties are negligent the injurer pays the full accident loss and his cost of care, thus this outcome could be an equilibrium only if $x^d > 100 - a(x^*)^{\frac{1}{a}}(y^*)^{\frac{1}{a}} + x^*$, where y^* is equal to 0, because the victim faces no liability. Therefore the condition becomes $x^d > 100 + x^* = 100$, where also x^* is equal to 0. However, $60 = x^d < 100$, hence the outcome where both parties violate the standards of due care is not an equilibrium under simple negligence, because the injurer has an incentive to deviate. An analogous argument proves the this outcome is not an equilibrium under contributory negligence.

[45] The first order conditions are $\sigma x^{\frac{1-a}{a}} y^{\frac{1}{a}} = 1 = (1-\sigma)\, x^{\frac{1}{a}} y^{\frac{1-a}{a}}$, which yields $\frac{x^*}{y^*} = \frac{\sigma}{1-\sigma}$. Substituting, we have $x^* = [\sigma^{a-1}(1-\sigma)]^{\frac{1}{a-2}}$ and $y^* = [\sigma(1-\sigma)^{a-1}]^{\frac{1}{a-2}}$.

[46] These values are obtained by means of a numerical simulation in the Mathematica 6.0 environment. The code is available with the authors. The exact values returned in the simulation are $\tilde{x} = 0.977435, \tilde{y} = 0.976587$, and $\sigma^*(x, y) = 0.60198864$. Given these equilibrium values, the totals costs for each of the parties when both are negligent are lower than if one party unilaterally deviates and takes due care: after rounding up, for the injurer, we have

$$x^d > \sigma^*(\tilde{x}, \tilde{y}) \left[100 - a(\tilde{x})^{\frac{1}{a}}(\tilde{y})^{\frac{1}{a}}\right] + \tilde{x} = 59.94$$

And for the victim we have

$$y^d > [1 - \sigma^*(\tilde{x}, \tilde{y}) \left[100 - a(\tilde{x})^{\frac{1}{a}}(\tilde{y})^{\frac{1}{a}}\right] + \tilde{y} = 39.96.$$

parties to take care and partially corrects for the dilution of the incentives due to the imperfect internalization of the accident loss. In particular, the levels of care obtained with an endogenous sharing rule are closer to the socially optimal levels than those obtained with an exogenous sharing rule; hence, the social loss is also less with endogenous sharing: $99.90 = S(\tilde{x}, \tilde{y}) < S(x^* y^*) = 99.99$. Summing up, the endogenous sharing rule proposed above enables the parties to lower social costs by violating excessive due-care standards and instead choosing levels of care that are closer to the socially optimal levels.

2.5. Extensions

2.5.1. Sequential care choices

In the previous sections, we have focused on parties who act simultaneously. In some accident contexts, parties act sequentially: this means that a party might be able to choose his or her level of care after observing the other party's care choice. If the courts make no errors, both parties are induced to take the socially desirable level of care (Wittman, 1981).[47] If the standards of due care are too high, however, comparative negligence induces efficient negligence just as it did in the simultaneous case.[48] Consider again Example 2 and assume that Xavier moves first. Under simple negligence, if Xavier does not take care he is liable. Hence he will choose to take care and spend \$30 instead of \$100. Given that Xavier takes care, Yvonne will also take care, because her cost of care (\$90) is less than the damages that she would bear (\$100) otherwise.

Consider now contributory negligence. If Xavier takes care, Yvonne will also take care. If Xavier does not take care, Yvonne's decision depends on the liability rule. Under contributory negligence, Yvonne faces a choice between taking care (\$90) and bearing the damages (\$100) and hence she will take care. Therefore, under contributory negligence, Xavier expects Yvonne to take care irrespective of what he does, and will find it more convenient to take care (\$30) rather than paying damages (\$100).

Under comparative negligence, if both parties are negligent, Yvonne bears a share of damages equal to \$75, which is less than her cost of care (\$90). Thus, if she observes that Xavier is negligent, she will also choose not to take care. Anticipating Yvonne's reaction, Xavier will choose not to take care and bear his fraction of damages (\$25) rather than pay

[47] In the model developed by Shavell (1983) inefficiencies arise under some liability rules because the first movers' choice of care affects not only the expected accident loss but also the probability that care by the second mover will be necessary. We do not consider this scenario here.

[48] If due-care standards are too low, all rules perform in a similar way.

the cost of care ($30). As in the simultaneous case, in the sequential case both parties decide not to take care when this is efficient. The result is even more robust here because the game has a unique equilibrium: the equilibrium in which both parties took care disappears. (We could obtain the same result if we let Yvonne move first.) Note that, as in the simultaneous case, comparative negligence induces negligence only when this is efficient. If Yvonne's cost of care were equal to $60, Xavier's and Yvonne's liability shares would be $\frac{30}{30+60} = 33.3\%$ and $\frac{30}{30+60} = 66.6\%$ and neither party would find it convenient to act negligently. This outcome would be efficient because the sum of the parties' costs of care is now less than the damages.

2.5.2. Courts err with respect to the parties' costs of care

We have argued that court errors are most likely to occur with respect to the probability and magnitude of the accident. However, in some cases the court might err with respect to the parties' costs of care. This might be the case because the court does not consider the cost of avoiding any inadvertent failure to take care by the parties (Grady, 1998). With wrong estimates of the parties' costs of care, the court will come to a wrong assessment of relative fault and hence might attribute an excessive or insufficient share of damages to either or both parties. Thus, comparative negligence might lose its error-correction feature. Nevertheless, it is plausible that in a large number of cases the courts will tend to under- or overestimate both parties' costs of care in a similar way, thereby preserving the balancing of relative fault unaltered. If this is the case, comparative negligence continues to have an error-correction function also when the court errs with respect to the parties' costs of care.

Consider once more Example 2 and assume that the court correctly calculates damages ($100) but underestimates the costs of care by 33%; that is, the court believes that Xavier's and Yvonne's costs of care are $20 and $60, respectively. This error makes the court conclude that the accident should have been prevented, because $20+$60=$80 is less than $100, and thus that the parties should be found negligent if they did not take care. Under simple or contributory negligence, this error results in an inefficient outcome: the parties will take care. The error is innocuous under comparative negligence. The parties' shares of liability are $\frac{20}{20+60} = 25\%$ for Xavier and $\frac{60}{20+60} = 75\%$ for Yvonne. These are the same shares that the court would have obtained if the costs of care had been correctly estimated (see the text accompanying Example 2). Thus, under comparative negligence the parties will be efficiently negligent. The example demonstrates a general result: when the court

makes the same mistake in assessing both parties' costs of care, the balance of relative fault is unaffected and hence the error-correction function of comparative negligence remains valid.[49]

2.5.3. Multiple tortfeasors

So far, the narrative of this article has focused on accidents between an injurer and a victim, but one could easily extend the analysis to consider accidents with multiple tortfeasors, such as accidents with two injurers and one victim. If courts make no errors, all rules perform in the same way (Landes and Posner, 1980). Instead, if the courts make the kind of mistakes analysed in this article, the rule of contribution between the injurers should be modelled according to the relative fault principle in order to assure that excessive due-care standards do not lead to excessive precaution. Consider the following example.

Example 4. An accident can be prevented if Xavier and Zachary (the injurers), and Yvonne (the victim) take care. Care taken by only one or two parties has no effect. Care costs Xavier \$90, Zachary \$60 and Yvonne \$30. If an accident occurs, damages amount to \$150.

This is an accident that should not be prevented because \$90+\$60+\$30=\$180 is greater than \$150. The comparative negligence rule combined with a contribution based on relative fault makes Xavier bear a portion equal to $\frac{90}{90+60+30} = \frac{3}{6}$, Zachary a portion equal to $\frac{60}{90+60+30} = \frac{2}{6}$ and Yvonne the remaining portion equal to $\frac{30}{90+60+30} = \frac{1}{6}$ of the damages. Consequently, if all parties are negligent, they will bear shares of damages amounting to $\frac{3}{6} \times \$150 = \$75$ (Xavier), $\frac{2}{6} \times \$150 = \$50$ (Zachary) and $\frac{1}{6} \times \$150 = \$25$ (Yvonne). Each party bears a share of damages that is less than his or her cost of care and hence no party has an incentive to deviate from the negligence equilibrium.

While apportioning damages according to relative fault reaches a desirable outcome, other rules may fail to do so when courts set due-care standards too high. Consider a rule of contributory negligence combined with a 50% contribution rule and assume that the

[49] This result is true beyond the example. Assume that the parties' costs of care are X and Y and that the court's estimates are aX and aY, where $a > 0$ can be greater or less than 1. Xavier's share of liability is $\frac{aX}{aX+aY} = \frac{X}{X+Y}$, which is unaffected by the court's error. The same applies to Yvonne's share.

court erroneously overestimates the expected harm and hence finds a party liable if that party did not take care. The victim bears the full accident loss if negligent and thus is induced to take precaution. The injurers share the damage equally if they are both negligent. Since $75 (Zachary's share of damages) is larger than $60 (Zachary's cost of care), Zachary will opt for taking care. Given that both Zachary and Yvonne have incentives to take care, Xavier will be left bearing full liability ($150), which exceeds his cost of care ($90) and induces him to take care.

2.5.4. Third-party externalities

There may be situations in which "excessively high" due-care standards are socially desirable. This is the case when accidents generate additional negative externalities, such as harm to third parties other than the victim. Once harm to third parties is taken into account, the socially optimal due-care standards ought to be higher than those that would be obtained by only considering harm to the victim. However, harm to third parties does not enter the parties' strategic calculations: by hypothesis, the injurer does not internalize harm to third parties. This is precisely because such parties are not part of the lawsuit against him, so their harm will not be included in the calculation of the damages award. Likewise, the victim bears the costs of harm to herself - if she does not receive compensation from the injurer - but not the cost of harm to third parties. Since harm to third parties remains out of the calculations of the injurer and the victim, the socially optimal due-care standards are excessively high from the viewpoint of the injurer and the victim. The injurer and the victim will choose their levels of care irrespective of harm to third parties.

Example 5. An accident can be prevented if both Xavier (the injurer) and Yvonne (the victim) take care. Care taken by only one party has no effect. Care costs Xavier $30 and Yvonne $90. If an accident occurs, damages amount to $100 (harm to Yvonne) plus $60 (harm to Zoe, a passive victim).

Clearly, this accident should be prevented because the total loss ($160) is larger than the sum of the costs of care ($120). However, assuming that Zoe does not sue in tort, comparative negligence may make it easier for Xavier and Yvonne to violate the due-care standards and hence may dilute the incentives to take care. This is because the parties will only consider harm to Yvonne when deciding whether to take care. If faced with the

prospect of bearing damages equal to $75 and $25, respectively, when both parties are negligent, Xavier and Yvonne will not take care. In contrast, simple and contributory negligence would result in both parties taking care, which in this case is socially desirable. The important implication here is that in situations where harm to third parties is an important concern, and is taken into account in the due-care standards, comparative negligence is an undesirable solution. Other rules, such as simple or contributory negligence, should then be preferred.

Why should Zoe not sue in tort? Negative third-party externalities may arise in all those cases in which not all victims are likely to sue the injurer. This may be because individual harm is trivially low - although aggregate harm might be very large, such as in some industrial accidents - or because not all victims have standing in court - such as in some environmental cases. In these cases, law and economics commentators have argued for the use of punitive damages (Polinsky and Shavell, 1988). Punitive damages do not remove the externality, because they only make the injurer, but not the victim internalize the harm to third parties. Yet, they remove the shortcomings of comparative negligence. Assume that damages are multiplied by 160%, for punitive reasons. As a result, under comparative negligence when both parties are negligent, the injurer pays 75% of $160 (the multiplied damages), that is , $120, which exceeds the injurer's cost of care and will induce him to take care. Given that Xavier takes care, Yvonne will also take care, since $30 is less than $100 (the harm to Yvonne). Thus, punitive damages correct the shortcoming of comparative negligence when there are negative externalities. Punitive damages also preserve the error-correction properties of comparative negligence, as the following modification of Example 5 shows.

Example 6. An accident can be prevented if both Xavier (the injurer) and Yvonne (the victim) take care. Care taken by only one party has no effect. Care costs Xavier $135 and Yvonne $45. If an accident occurs, damages amount to $100 (harm to Yvonne) plus $60 (harm to Zoe, a passive victim).

In this case, the accident should not be prevented because the sum of the costs of care ($180) exceeds the total harm ($160). Yet, with punitive damages, simple negligence induces the injurer to take care (because $135 is less than $160); consequently the victim will do the same (because $45 is less than $100). Hence simple negligence with punitive damages results in both parties taking care, which is not socially desirable. Instead, if

Yvonne is negligent, Xavier pays \$120 (that is $\frac{135}{135+45} = 75\%$ of \$160), Yvonne earns \$120 - \$100 = \$20 (what she receives from Xavier minus her actual harm) if she is negligent, and \$160 - \$100 - \$45 = \$15 (the full damages minus her harm minus her cost of care) is she is non-negligent. Since also her net surplus is larger when she is negligent, we can conclude that both parties will be negligent, which is the desirable outcome. This shows that comparative negligence has an error-correction property even with punitive damages.[50]

Cooter and Porat (2006) identify a mirror-image case, in which the externality to third parties is positive. For instance, medical doctors' liability only considers the downside of their activity: the possibility that a medical treatment results in harm to the patient. However, there might be a relevant upside that is never internalized, as when the doctor takes some risks in order to save the patient's life. The doctor may bear liability if the patient dies but is not rewarded is the patient survives. This asymmetric treatment of otherwise symmetrical events generates a positive externality. In our framework, this results in the desirability of lowering due-care standards below the levels that would be optimal for the parties to the dispute only. This scenario of positive externalities leaves our analysis unchanged. If the standards are accurately set, all negligence rules perform in the same manner, while comparative negligence may be preferable if errors are taken into account.

2.5.5. Litigation rate

An additional factor to consider is the effect that the choice of negligence rules has on administrative costs. As explained above, comparative negligence leads to more negligence than other negligence rules in the case of erroneous due-care standards. More negligence may mean more harmful accidents or more frequent accidents. Our analysis is based on the consideration that, if the due-care standards are too high, by hypothesis more harmful or

[50] This result is true beyond the example. Assume that the parties' costs of care are X and Y, harm to victim is L and harm to a third party is H. Assume further that damages plus punitive damages are equal to $L + H$. If Yvonne is negligent, Xavier will prefer to be negligent if $\frac{X}{X+Y}(L + H) < X$, that is, if his liability share is less than his cost of care. The latter inequality can be rewritten as $L + H < X + Y$, which guarantees that the injurer will choose negligence if and only is this outcome is socially desirable (the sum of the costs of care exceeds the harm). Likewise, if Xavier is negligent, Yvonne will prefer to be negligent if $L - \frac{X}{X+Y}(L + H) < Y + L - (L + H)$, that is, if the harm she suffers, minus the damages paid by Xavier when both parties are negligent is less than her cost of care plus the harm she suffers, minus the damages paid by Xavier when he is unilaterally negligent. The latter inequality can be rewritten again as $L + H < X + Y$, which guarantees that also the victim will choose to be negligent is and only is this outcome is socially desirable.

more frequent accidents can actually result in an increase in social welfare because the additional costs to society are more than compensated by reduced costs of care. Nevertheless, if comparative negligence results in more harmful or more frequent accidents, one could associate this outcome with higher litigation rates and hence higher administrative costs.

The relationship between negligence rules, the harmfulness or frequency of accidents, and litigation is complex. On the one hand, more harmful accidents raise the stakes of the lawsuit and parties might be more prone to litigate than to settle, a result that follows from the standard model of litigation. Comparative negligence, by inducing parties to take less care, may induce more harmful accidents and hence higher litigation rates. In turn, the larger costs for the system might more than offset the efficiency gains in terms of comparative negligence. The case of more frequent accidents is even more straightforward. If more accidents occur, there will be more disputes and hence more litigation in absolute terms, even if the litigation rate does not increase.

On the other hand, de Mot (2013) shows that comparative negligence may reduce the stakes of the dispute compared to rules of simple and contributory negligence, in which the outcome is binary: a party either pays full damages or does not pay anything. In contrast, under comparative negligence parties litigate over marginal changes of the damages to be awarded, and hence may be prone to settle more often or to invest less in litigation. This results in lower administrative costs per accident. On balance, the effect of comparative negligence on the total administrative costs is ambiguous.

2.6.Conclusion

In this paper, we have advanced a novel formal theory to explain why comparative negligence is such a frequently used rule. We have shown that comparative negligence can serve as a buffer against erroneous due-care standards, by inducing efficient violations more frequently than other negligence rules. What distinguishes our approach from previous literature is that we do not compare the social welfare resulting from the different rules in general, but rather identify those cases in which comparative negligence could make a difference by inducing parties to be (efficiently) negligent, who would otherwise follow due-care standards. We then show that in the remaining set of cases, negligence rules cannot be ranked and the effects of social welfare depend on the circumstances.

Our analysis formalizes the notion of efficient negligence developed by Grady (1998)[51] in the context of unintended violations of the negligence standard. In Grady's analysis, preventing all unintended violations of the negligence standard is too costly and hence certain violations occur efficiently. Grady argued that comparative negligence, by splitting the loss between the parties stimulates efficient violations of the negligence standards. Although we have not formally modelled unintended violations, our framework captures the idea that while parties might be aware of the inability to comply all the time, courts might be unable to assess the costs and benefits of inadvertent violations and hence set the due-care standards at a too high or too low level.[52] As we have shown, if parties have an informational advantage over courts, comparative negligence gives parties incentive to be efficiently negligent.

The core of our argument is that, if due-care standards are too high, then it can be socially desirable that the parties violate such standards. Comparative negligence, with its low-powered incentives, is the rule that most often induces such efficient violations. Empirical studies have shown that comparative negligence does, in fact, induce lower levels of care than contributory negligence (Sloan et al., 1995; White, 1989). In addition, we have shown that if due-care standards are too low, all rules induce the same levels of care. Our analysis also offers support for a specific determination of the apportionment rule (relative fault), which courts should use to share damages among non-negligent parties both when there is a single injurer and with multiple tortfeasors. Finally, our theory offers a testable hypothesis concerning the emergence of comparative negligence: the emergence of comparative negligence in relatively recent times could be due to the difficulty for courts to determine the due-care standards in an increasingly complex world.

[51] See also Grady (1984, 1990).

[52] As we have explained in Section 2.2, our model does not relate to the fact that a party might notice that the other party have failed to take care.

3. A Comparative Review of the Protection of Traditional Knowledge – a Theory of Three Approaches

ABSTRACT

This paper presents a new dataset of existing legislation on the protection of traditional knowledge, as it is reported to the WIPO. A theory of three approaches is introduced, explaining that the legislation that protects traditional knowledge can be subdivided in three distinct approaches, each with specific characteristics. The economic empowerment approach, through which the legislator seeks to create opportunities for the economically weaker indigenous groups in society to monetize on their traditional knowledge. The preservative protection approach, in which the legislator seeks to preserve folklore for the future and for the benefit of the country as a whole. And the cultural integrity approach, used to prevent the offensive and inappropriate use of sacred culture, historical objects and authentic new traditional knowledge products. A statistical analysis shows that the theory of the three approaches explains up to 81% of the variation found in the legislation on traditional knowledge reported to WIPO.

3.1. Introduction

At the July 18-22 2011 meeting of the WIPO[53] intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and folklore (IGC) the members of said committee have agreed to recommend the renewal of their mandate. The IGC's mandate calls, amongst others, for the creation of instruments for effective protection of Traditional Knowledge (TK). It seems that for such a task it would be instrumental to have an overview of the legislative instruments that currently exist for that purpose.

TK is a broad concept that encompasses objects, stories, rituals and traditions. It holds cultural, economic and historic value, which explains why legislators are looking for ways to protect and realize these valuable assets. Such protection can be difficult when the forms of TK do not fit into existing concepts such as intellectual property, tangible property etcetera. This search for forms of legislation is still ongoing, as various legislators have found different forms of legislation to protect TK.

This paper provides such an overview of existing legislation regarding the protection of TK, with the exclusion of Genetic Resources. All legislation reported to the WIPO is listed in a database and categorized with respect to its legal content. The categorization includes, inter alia, which forms of TK are protected, whom they are protected for and what they are protected from. A theory of three approaches is introduced, explaining that the existing legislation protecting TK can be split up in three approaches, each with distinctive characteristics. The economic empowerment approach, which seeks to create opportunities for the economically weaker indigenous groups in society to monetize on their TK. The legislation creates the possibility for indigenous communities to pursue active commercial interests for their traditional medicinal knowledge. South American countries with a relatively high GDP, and Asian countries with a relatively low GDP are likely to follow this approach. The preservative protection approach seeks to protect folklore for the benefit of the state or the country as a whole. This approach is found a lot in African countries, and outside of Africa one is more likely to find it in the legislation of countries with a relatively low GDP. The cultural integrity approach seeks to prevent the offensive and inappropriate use of sacred culture, historical objects and authentically created new objects. Legislation following this approach is most likely to be found in Oceanian countries with a high GDP, North American countries with a high GDP, or countries with a high GDP in general.

[53] World Intellectual Property Organisation.

Statistical analysis shows that the theory of the three approaches explains up to 81% of all variation in the legislation that was reported to protect TK around the world.

Legislators can follow either one of these approaches or can combine more than one approach in their legislation regarding the respective forms of TK.

On what TK exactly entails one could have an endless discussion. In fact, a discussion on a formal definition of TK is currently on-going within the WIPO framework. Various suggestions have been made for a definition, and the current debate, amongst others, focuses on taking into account the purpose for the definition (intellectual property forms of protection, or also other policy contexts such as the preservation of cultural heritage, promoting biodiversity, or a human rights context), but it also focuses on the aim for a general coherence and compatibility between various policy instruments. For an elaborate portray of the on-going discussion, see WIPO Traditional Knowledge - operational terms and definitions[54].

For the purpose of this paper I will use one of the definitions as issued by WIPO[55]:

> *'Traditional Knowledge' refers to tradition-based literary, artistic or scientific works; performances; inventions; scientific discoveries; designs; marks; names and symbols; undisclosed information; and all other tradition-based innovations and creations resulting from intellectual activity in the industrial, scientific, literary or artistic fields. 'Tradition based' refers to knowledge systems, creations, innovations and cultural expressions which:*
>
> - *have generally been transmitted from generation to generation;*
> - *are generally regarded as pertaining to a particular people or its territory; and*
> - *are constantly evolving in response to a changing environment.*

In the list of examples of categories that TK could include one example is, *"expressions of folklore" in the form of music, dance, song, handicrafts, designs, stories and artwork.* So expressions of folklore (folklore hereafter), are considered to be a part of TK, under the WIPO definition. This definition expressly excludes from the description:

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[54] WIPO Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and folklore, Traditional Knowledge – Operational Terms and Definitions, 20 May 2002, WIPO/GRTKF/IC/3/9.

[55] WIPO, Intellectual Property Needs and Expectations of Traditional Knowledge Holders: WIPO Report on Fact-Finding Missions on Intellectual Property and Traditional Knowledge (1998-1999), April 2001. as referred to in WIPO Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and folklore, Traditional Knowledge - Operational Terms and Definitions, 20 May 2002, WIPO/GRTKF/IC/3/9.

(...) items not resulting from intellectual activity in the industrial, scientific, literary or artistic fields, such as human remains, languages in general, and other similar elements of "heritage" in the broad sense.

Whenever the term indigenous peoples, or indigenous communities is used in this paper, I will do so with the definition as made by the ILO[56] in mind.

'Indigenous peoples' are defined as*:*

> *(...) peoples in independent countries who are regarded as indigenous on account of their descent from the populations which inhabited the country, or a geographical region to which the country belong, at the time of conquest or colonization or the establishment of the present state boundaries and who, irrespective of their legal status, retain some or all of their own social, economic, cultural and political institutions.*

From the given definition of TK it already becomes clear that the concept is quite broad and vague. This is done in the WIPO context, so as to not ex ante exclude any particular expression from the definition, before a clear framework of Intellectual Property (IP) protection is created. This broad scope of TK has the effect that the forms of expressions that are considered to fall under TK can vary a lot.

To demonstrate the wide range of 'knowledge' that falls under this broad concept of TK, examples[57] include not only dances, music and ceremonies, but also games, folk tale and mythology. It also includes tangible expressions such as art, instruments and architectural forms, but also intangible concepts such as spirituality, ethics and moral values. Traditional measures for food preparation, agriculture and conservation, and also practices of health care and education are mentioned as well.

The difficulty with the protection of TK, lies in the fact that it does not fit into the common concepts that we use to protect forms of knowledge. Gervais (2005) provides a general analysis on how well the concepts of IP fit with the concepts of TK in a

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[56] International Labor Organization Convention 169, Convention Concerning Indigenous and Tribal Peoples in Independent Countries, June 7, 1989, art 1(b).

[57] The given examples are taken from the following sources: UNESCO – WIPO Model Provisions for National Laws on the Protection of Expressions of folklore Against Illicit Exploitation and Other Prejudicial Actions of 1982, section 2; UNESCO Recommendation on the Safeguarding of Traditional Culture and folklore of November 15, 1989, adopted by the General Conference at its 25th session in Paris; UNESCO Symposium on the Protection of Traditional Knowledge and Expressions of Indigenous Cultures in the Pacific Islands, Noumea, 15-19 February 1999; and *Indigenous Knowledge, Local Pathways to Global Development, Marking Five Years of the World Bank Indigenous Knowledge for Development Program*, Knowledge and Learning Group, Africa Region The World Bank, 2004.

compatibility analysis. Current IP concepts, like copyrights, trademarks and patents generally apply to concepts with the following three characteristics (Gervais 2005, p. 141):

- An identifiable originator, like and author or inventor;
- An identifiable work, like an invention or a sign;
- Defined restricted acts.

As the examples of TK - mentioned above - already suggest, TK does not always show a comfortable fit with these three characteristics. TK is not static, it is ever evolving, and therefore it is sometimes hard to specifically describe and identifiable work. Each tribe of a certain indigenous people can have their own variation on a traditional game or ceremony, even though they are by the indigenous peoples themselves considered to be part of the same TK. This also leads to the problem that the originators of TK are seldom identifiable, as TK is often passed on and evolved over generations, as one could imagine is the case with folk tale and mythology, but also with practices of healthcare and food preparation.

The literature on the protection of TK can be roughly categorized in three groups. The first discusses the political process and the challenges that are being faced by international undertakings to protect TK. The second group of literature zooms in on specific forms of TK, and how they can be protected. The third group of literature consists of case studies, comparing various approaches that countries have taken to protect TK.

As stated before, in the recent past an increasing interest in the protection of TK can be seen in international arenas (Yu 2003). In the WTO[58], TK has emerged as an important issue on the agenda (Bodeker 2003). The CBD[59] and the IUPGR[60] are examples of international agreements that such increased interest can lead to. However, it is believed that a divide exists between developed and developing countries in the way this increased interest shows itself (Ntambirweki 2001, and Ghosh 2003). Developing countries have become more proactive in advancing TK as an issue to be dealt with on international forums[61]. Developed countries seem to be more inclined to either not consider TK such a pressing issue, or to deal with TK-protection in their own domestic legal systems[62].

Examples of literature regarding TK protection focusing on the challenges an international approach to the protection of TK would face (for example Arewa 2006, Yu

[58] World Trade Organisation.
[59] Convention on Biological Diversity, Rio de Janeiro, 5 June 5, 1992.
[60] The International Treaty on Plan Genetic Resources for Food and Agriculture, of the Food and Agriculture Organization of the United Nations., Also known as the International Seed Treaty, adopted by the FAO Conference on 3 November 2001.
[61] For example: Venezuela in WT/GC/W/282 at the WTO.
[62] For example: Australia and the US: see Grad, R. (2003) p.203.

2003 and 2008). McManis (2003) Provides a description of ongoing international initiatives, exemplary for the so called "global thinking" regarding TK protection. Dutfield (2001) goes as far as to state that TRIPs is not an appropriate forum to develop TK protection. Ghosh (2003) discusses three case studies, and concludes that in a mix of domestic and international law IP can be used strategically to protect what he calls "traditionally subordinate groups", through the definitions of basic IP concepts such as prior art and novelty. He also points out the threats of appropriation that IP law can pose to TK. Gupta (1999) suggests regional cooperation between India, Brazil and South-Africa to find a protection for biological TK and traditional medicine, while mixing the informal traditional constitutional contexts in with the formal western institutions to develop policy in this regard.

Most literature on the protection of TK does not enclose all forms of TK. The bulk of the literature focusses on Knowledge regarding Biological TK, and/or on traditional medicine. Possibilities for sui generis rights for genetic resources and Biological TK are explored by Cottier and Panizzon (2004), Downes (2000) and Halewood (1999). The same is done by Bodeker (2003) but for traditional medicine.

Another direction of the literature discusses case studies of specific countries or projects. Grad (2003) compares the experiences of the US and Australia regarding the different paths the development towards expanding of their IPR systems have taken, to rectify inequality for indigenous peoples. In Australia this development initiated in court rulings, spilling over into legislation. In the US the legislator initiated this process in a response to perceived injustices in courts. Kutty (1999) compares the national experiences of India, Indonesia and The Philippines with respect to the protection of folklore, although he uses a broader definition of folklore than is done is this paper, including for instance arts and crafts. Kuruk (1998) describes various national legislations on the African continent regarding the protection of folklore, and discusses how unprotected this African folklore is in the US. Frankel (2007) explores the opportunities in trademark law to provide protection for TK, and compares the New Zealand experience with the US experience. McManis (2003) analysis a case study of the ICBG[63]-Peru Project as exemplary for a more novel way of using IP to protect TK. The cooperation of 5 organisations, 3 universities, a corporate party and an organisation of indigenous peoples, leading to a combined patent application regarding traditional plant knowledge of the Aguaruna people of Peru.

[63] International Cooperative Biodiversity Group.

The literature regarding the national experiences is very educational, as they zoom in on a small group of countries. They give an elaborate analysis of the legislation, the TK and the challenges faced by the parties involved in the provision of protection of TK. These analysis give an in depth, but still only fragmented view of the existing legislation on the protection of TK. What is currently still missing is an overview of these national experiences. A birds-eye-view if you will, of the form and focus of national legislation. That is where this paper comes in. Firstly by giving an overview of legislation on the protection of TK, as reported to the WIPO, and analysing the directions that the various national legislators have chosen. Secondly this paper looks for similarities and differences in the legislation regarding the forms of TK that are protected, the people whom the TK is protected for, and what threats the TK is protected from. The analysis shows that the existing legislation protecting TK can be split up in three separate approaches, each with their distinctive characteristics.

In section 3.2 a description of the database consisting of the categorized Legislation on the protection of TK is given, together with an explanation of how the database was constructed. Section 3.3 provides a descriptive and statistical analysis of the database, explaining and describing the three distinctive approaches of the national legislators. Section 3.4 concludes.

3.2. Legislation on the protection of TK – description of the database

As mentioned in the introduction, the various forms of TK do not always fit into IP concepts, such as trademarks, copyrights or patents. This can lead to unwanted situations. An example, taken from Gervais (2005), deals with commercial sound recordings using traditional music from indigenous people. When the original composer of such traditional music within the indigenous people cannot be identified, the music is not protected by copyright. A situation can then occur where a part of such traditional music is used in (a part of) new commercial sound recordings, by an artist who does not belong to this indigenous people. This new commercial piece of music can then be protected by copyright, as long as it fits all criteria. This leads to the situation that someone belonging to the indigenous people, may be prevented from using their own culture's music in a commercial way, if it is considered to infringe on this newly established copyright. It seems obvious that this cannot have been the goal of the IP laws in place, or at least that this is a worrisome situation. There are various ways in which legislators have decided to deal with this discrepancy. In this section a dataset is introduced that gives an overview of

the forms in which states have provided protection of Traditional Knowledge in their domestic legislation.

In most countries it has been recognized that there are various forms of TK that do qualify for 'normal' IP protection, as long as they fit the three characteristics that are mentioned in the section 3.1. An indigenous artist's painting can be protected by copyright. An indigenous people can trademark a sign or emblem, as long as it fulfils the three characteristics. Most countries that provide IP protection provide such a form of protection for TK. These forms of IP protection are often based on various guidelines and international treaties, such as the Berne Convention[64], the WCT[65], The TRIPs[66] agreement, and the WPPT[67] to name a few. In this section, however, I will focus on the protection that goes beyond these frameworks.

The TRIPs agreement creates a framework of minimum standards for IP protection that every member has to uphold. The agreement is a result of the WTO negotiations in the Uruguay round. These international standards, however, require domestic legislation for their implementation. A certain degree of freedom in the way these standards are implemented is left to the discretion of the national legislators. This results in a situation where the WTO members each have their own domestic legislation, all meant to implement the same standards as set in TRIPs. An added diversification to this format is that the standards are minimum standards, and that member states are allowed to set their national standards of protection higher, if they wish to do so. In theory this results in all member states providing at least the minimum standards of IP protection, and some member states providing higher levels of protection.

It does make sense, therefore, when addressing the status of legal protection of TK, to take the position of TK in the TRIPs treaty into account.

With the creation of the dataset an overview is given of the existing domestic legislation of TK protection around the world, and a comparative analysis is done of the contents of these legislations. In section 3.2.1 the dataset, and the way the data were gathered are explained. Section 3.2.2 explains the qualitative categorization of the data.

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[64] Berne convention for the protection of literary and artistic works, as revised in Paris, July 24, 1971.

[65] World Intellectual Property Organization Copyright Treaty, Geneva, December 20, 1996.

[66] Agreement on Trade Related Aspects of Intellectual Property Rights, Annex 1C of the Marrakesh Agreement Establishing the World Trade Organization, Marrakesh, April 15, 1994.

[67] World Intellectual Property Organization Performances and Phonograms Treaty, Geneva, December 20, 1996.

3.2.1. Selection of the data

This section gives a brief explanation of how the database was composed. Which legislative texts were included, and how the legislation was obtained.

Listed states: All member-states of the WIPO are requested to report their legislation on the protection of TK. The states that have been listed in this overview are all states that have indeed reported to have such domestic legislation on TK to WIPO. Some states that are not members of WIPO have reported legislation on TK to WIPO, and are therefore also enclosed in this overview. These states are all island nations in the Pacific Ocean: The Federated states of Micronesia, Palau and Vanuatu. [68]

Membership of both the WIPO and the WTO, as of April 2012 are listed for the states in the database.

Listed Legislation: The legislation on which this listing is based is the legislation that states have reported to WIPO. And whenever in a text there is a reference to a specific other legal document that document has as well been listed in this overview. In the legislation that was provided by Ecuador, a reference is made to a law containing a sui generis right for collective IPR's of indigenous communities, that is to be created[69]. At the moment of writing no such right had been implemented yet[70]. Hence no such sui generis right is recorded in the database.

Legislation that contained no reference to TK in any form as defined above has been left out of this overview.

For the framework of this overview the definition used for TK is the same as mentioned in section 3.1. The WIPO definition of TK also encloses genetic resources, such as agricultural, biodiversity-related, and ecological knowledge. In WIPO genetic resources are both discussed as a part of TK[71], but the way it is referred to as separate from TK (often in the phrase "Genetic Resources, Traditional Knowledge and Folklore") shows some ambiguity on whether or not genetic resources should be considered a part of TK. Genetic resources are a form of TK that is regulated differently from other forms of TK. Living organism have qualities that TK does not necessarily have.

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[68] Neither of these states were members of the WIPO at the moment of the creation of the database. However Vanuatu has become a member of the WIPO as of March 2 2012.

[69] Law on Intellectual Property of Ecuador, 1998, art. 377.

[70] As of 11th of August 2011.

[71] WIPO, Intellectual Property Needs and Expectations of Traditional Knowledge Holders: WIPO Report on Fact-Finding Missions on Intellectual Property and Traditional Knowledge (1998-1999), April 2001. as referred to in WIPO Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and folklore, Traditional Knowledge - Operational Terms and Definitions, 20 May 2002, WIPO/GRTKF/IC/3/9.

Mainly migratory qualities of certain species originally prompted the protection of particular species through treaties, as early as the first half of the last century[72]. The vast body of international treaties that has come into existing since then, arguably with The Convention on Biological Diversity (CBD) as a relatively recent climax in 1992, and its advanced evolvement compared to other international undertakings to TK protection shows that even if genetic resources would be considered a part of TK, they could be seen as an odd one out among the various forms of TK that exist. Therefore, to prevent confusion on the matter, all knowledge related to genetic resources, biodiversity, ecological and agricultural knowledge are seen as separate concepts form the other forms of TK and will be referred to with the broader term "biological knowledge". There are many similarities to be found between the existing approaches to biological knowledge protection and the existing and possible approaches to TK protection, and much can be learned from the former with respect to the latter. However the protection of the two types of knowledge have shown very different patterns in their historical developments. The development of biological knowledge protection has historically developed top-down, from international treaties to domestic regulation, and the protection of TK has shown a bottom up development, and arguably has come up as an issue more recently. This has led to the exclusion of biological knowledge from the current analysis.

Whenever a domestic legislation enclosed a protection of biological knowledge, it is marked in the dataset, but the protection is not categorized according to the qualifications that the other TK protection is categorized.

States' classification: The reporting by the states to WIPO also includes a classification of the legislation, as it is used by WIPO. These qualification are called "Traditional Knowledge", "Traditional Cultural Expressions", and "Genetic Resources". WIPO does not provide any conclusive definitions on these terms, which leads to differing interpretations and confusion in the use of this terminology. Therefore it is not used in this paper. For a further discussion of the ambiguity of the use of these WIPO terms see appendix 3.1. Due to the definition that is being used in the listing of this database, both legislation that was reported to regard "Traditional Knowledge" and "Traditional Cultural Expressions" has been taken into account in this overview.

[72]Early examples, taken from Bodansky, International Law and Protection of Biological Diversity, 28 *Vanderbilt journal of Transnational Law,* 623, 1995, footnote 3 include: *The Convention for the Protection of Migratory Birds*, August 16 – December 8, 1916, between the USA and the UK, 39 Stat. 1702, *The Convention for the Regulation of Whaling*, September 24, 1931, 49 Stat. 3079, 155 L.N.T.S. 349.

The legislation that was reported to regard "Traditional Knowledge" and/or "Traditional Cultural Expressions", but in fact only provided protection for biological knowledge has been recorded as such.

Benchmark TK protection: Although not all WIPO Memberstates, and hence not all states listed, are Member to the TRIPs agreement, the minimum standards of TRIPs have been used as a benchmark to report the legislation.[73] Only legislation that provides any form of protection of a higher standard than the minimum standards of TRIPs have been listed. For the minimum standards only the forms of protection have been taken into account. The term of protection have not been taken into account. For example six countries[74] had registered to have domestic legislation protecting "Traditional Cultural Expressions". Each of these six countries registered their general IP laws on copyrights, patents, trademarks etcetera. Neither of these six IP laws provide protection beyond the TRIPs standard. This means that the TK can only be protected as long as it fulfills the three requirements mentioned in section 3.1, such as an original painting that was made by an identifiable artist, not that long ago that the term of protection has ended. In the legislation of Macedonia this is explicitly mentioned[75], as in the other countries' legislation it can only implicitly be deduced from the text. The legislation of these countries was marked as not exceeding the minimum standards of TRIPs.

3.2.2. Categorization

The content of the legislation has been categorized. In this section the classification system is discussed that was used for the categorization.

As the definition of TK shows, it is a broad term, and encompasses a lot of different forms of knowledge. The states that have provided for some sort of TK protection have done so, but for varying forms of TK. To distinguish between the various forms of TK a categorization has been made. In the database the following categories of TK have been identified:

[73] At the moment of construction of the database, April 2012, There were 38 states that were a member of the WIPO, but were not a member of the WTO, and hence of the TRIPs agreement.

[74] Fiji, Macedonia, The Federated states of Micronesia, Mongolia, Ukraine and the United Kingdom.

[75] Art 6, Law on Copyright and Related Rights, of September 12, 1996, as amended by the Law of January 22, 1998, Macedonia.

- Traditional medicine: The knowledge with respect to medication as well as techniques used in medicine.
- Authentic new objects (newly and authentically produced objects): Handicrafts, clothing, art and other tangible objects.
- Historical TK objects: TK objects that are considered historical artifacts due to the time when they were produced and used.
- Sacred culture: Religious or sacred places, expressions or rituals.
- Folklore: Traditional cultural expressions such as stories, songs, dances.
- Designs: Patterns used in handicrafts, art or clothing.
- Non-TK protected: Knowledge that does not fall under the TK definition used here, but has been protected by some of the reported regulations entails:
    - Biological knowledge: such agricultural knowledge, ecological knowledge and biodiversity related knowledge. Biological knowledge is excluded from this listing of TK. However certain domestic regulations protect not only the knowledge that falls under the definition of TK that is used here, but also provide some form of protection for biological knowledge at the same time. Although for the purpose of this categorization this is not considered TK protection, it is recorded when a state has provided such protection.
    - Other: Other forms of TK that have been mentioned are:
        - Human remains[76]
        - Animals[77]
        - Geographical indications[78]
        - Living individuals holding knowledge that is considered TK[79]

Although these concepts do not fall under the definition of TK as used in this analysis, they are considered to be TK by the states reporting their legislation as laws protecting TK. Which is why they are listed under the "other" category.

- Rightholders: Answers the question who own the intellectual property of the TK, and who reaps the (economical) benefits of that TK. These are categorized as either

[76] In the Aboriginal and Torres Strait Islander Protection Act, 1984, Australia, and the Native American Graves Protection and Repatriation Act (NAGRPA), 1990, USA.

[77] Protection of Cultural Heritage Act, as amended by Act no. 8346, Apr. 11, 2007, Republic of Korea.

[78] Decreto Legislativo N° 1075: Decreto Legislativo que aprueba Disposiciones Complementarias a la Decisión 486 de la Comisión de la Comunidad Andina que establece el Régimen Común sobre Propiedad Industrial, Peru.

[79] In the Historical and Cultural Preservation Act, 1995, Palau.

the state (or a state organ or agency), indigenous communities as a group, or individuals.

- Who instigates: Answers the question who has to take the initiative to get the TK protected. These also are categorized as either the state (or a state organ or agency), indigenous communities as a group, or individuals. The amount of action that is required from the holders of TK can determine the extent to which the possibilities of TK protection are actually brought in practice.
- Protected interests: The types of protection provided is split up in three categories:[80]
    - Active commercial interest: allowing parties to benefit commercially from the economic advantages that can stem from TK;
    - Defensive commercial interests: preventing parties other than the party appointed as the rightful owner to benefit commercially from the TK;
    - Ethical concerns: to avoid offensive use of TK, or to give recognition to the source of the TK used.
- GDP: in the analysis the GDP of the states is taken into account. For these data the IMF 2010 GDP per capita PPP in international dollars is used. For two states these data were not available. For Palau and The Federal states of Micronesia the Worldbank 2010 GDP per capita PPP in international dollars is used.
- Region: in the database the continents the countries belong to are listed to look for regional preferences. The continents are grouped according to the seven continent model of the United Nations Geoscheme. Countries that have territory spanning overland continental boundaries are listed to belong to both continents[81]. Countries with overseas territories in other continents then their mainland are only listed as belonging to the continent of their mainland.

3.3.Analysis

The database provides us a more ordered and organized overview of the contents of the national legislations protecting TK. Taking a closer look at the data provides insights in the similarities and differences between the different countries with respect to their legislations. In section 3.3.1 a comparative analysis is given based on the birds-eye-view

[80] This classification is taken from WIPO/GRTKF/IC/3/10, paragraph 100.

[81] These countries were Egypt (Africa and Asia), and Azerbaijan, Georgia, Kazakhstan, Russia, Turkey (Europe and Asia).

the database provides. This so called “eyeball analysis” discusses the descriptive statistics of the database. Section 3.3.2 discusses regional preferences regarding the protection of TK, and in section 3.3.3 a theory of three approaches is introduced regarding the underlying preferences of legislators for the protection of TK, and how that links to the legislative choices they made. In section 3.3.4 a statistical analysis is used to verify and fine-tune this theory.

3.3.1. Reported legislation

The first thing that stood out during the building of the dataset, were the discrepancies between the reported content of the legislation and the actual content. The reporting states labelled the reported legislation as either regarding genetic resources, TK or traditional cultural expressions (folklore). As can be seen from the WIPO definition all three of these forms fall within the definition of TK, so some confusion can be expected here. But what some states reported as legislation regarding TK actually turned out to be legislation regarding Genetic Resources[82]. Some legislation turned to provide a protection beyond what is defined as TK, for instance also certain human remains [83] or even living individuals [84] were protected under reported legislation. Also legislation regarding geographical indications of origin [85] was reported. In defence of these states, these particular legislations were reported together with other legislations that did regard actual TK, so they could be assumed to be reported for thoroughness sake more than anything else. This does show, however, that even though WIPO has provided an elaborate working definition for TK, there still is quite unclarity about what really is and, maybe even more important, is not TK.

3.3.2. Regional preferences

Another point that stands out before any statistical analysis is done on the database, is the difference in focus of the legislation. A lot of legislation regarding Biological TK was reported, relative to other forms of TK. Just to give a first impression of this, Figure 4 shows a histogram. This histogram shows the relative number of states per region with

[82] For example Switzerland, Portugal and Bhutan.

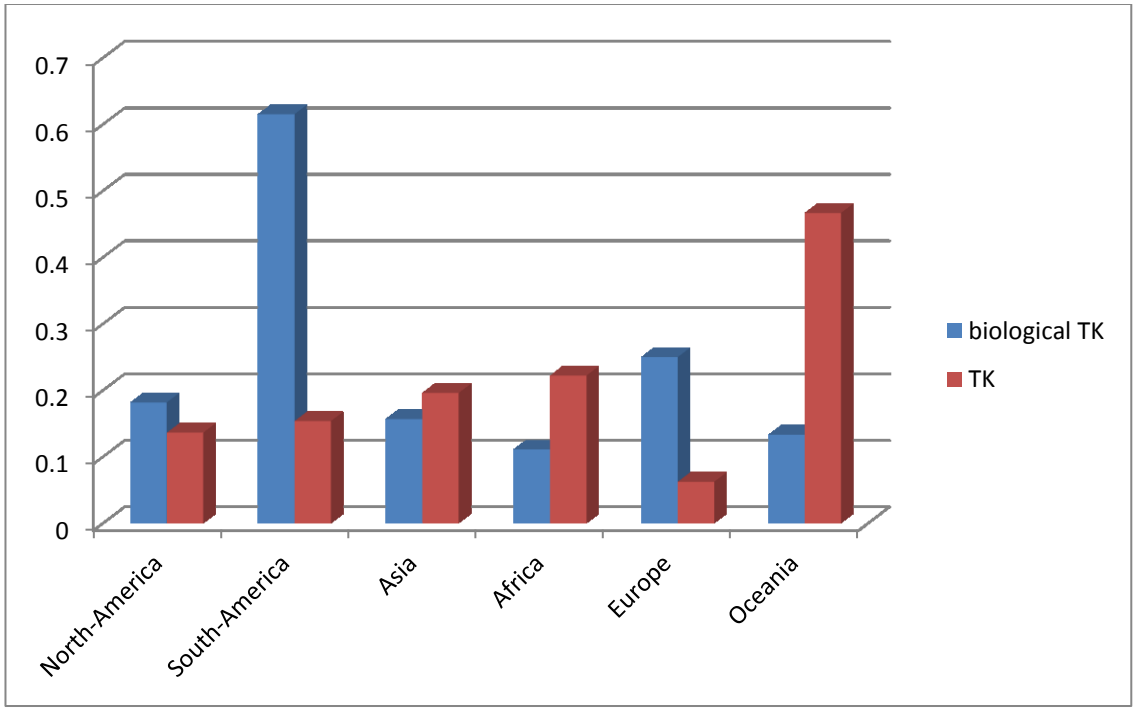
[83] In the Aboriginal and Torres Strait Islander Protection Act, 1984, Australia, and the Native American Graves Protection and Repatriation Act (NAGRPA), 1990, USA.

[84] In the Historical and Cultural Preservation Act, 1995, Palau.

[85] Decreto Legislativo N° 1075: Decreto Legislativo que aprueba Disposiciones Complementarias a la Decisión 486 de la Comisión de la Comunidad Andina que establece el Régimen Común sobre Propiedad Industrial, Peru.

legislation regarding Biological TK on the one hand and legislation regarding other forms of TK on the other hand[86].

Figure 4. Relative number of states per region that have reported legislation.



What this shows is that a relative large number of South-American states[87] have legislation protecting Biological TK[88], while in Oceania the focus is much more towards non-biological TK[89], as there are significantly more states in Oceania with such legislation than in other regions[90]. Europe has significantly less legislation on TK protection[91]. Explanations for these relations could be sought in the presence of specific forms of TK in certain regions: there is probably more non-biological TK in Oceania than in Europe, and there is a lot of biological TK to be found in South-America, and hence more biological TK to be protected. But this can by no means be the full explanation of these variations, as at first sight one might suspect that the presence of TK and biological TK in regions such

[86] The correlation between the regions and the reported legislation of TK and biological TK are listed in appendix 3.2.

[87] 62% of all South-American states.

[88] The correlation coefficient between the variable South America and the reporting of biological TK is significant at a level of 2%.

[89] 47 % of the states in Oceania have legislation protecting non-biological TK.

[90] With a significance level of 1% the correlation coefficient between the variable Oceania and the reporting of legislation on TK is significantly different from 0.

[91] 4% of all European states have reported legislation on non-biological TK, the correlation coefficient between the variable Europe and TK is significant at a level of 1%.

as Africa and Asia is not fully captured by the presence of legislation protecting the knowledge. This means that there must be more reasons and interests than just the availability of TK, that influence the legislative choices on the protection of TK.

When the non-biological TK legislation is categorized per type of TK, there are some significant links between the region a state belongs to and any of the type of TK that was protected Asian countries show a significant preference for the protection of traditional medicine. Oceanian countries show significant preferences for the protection of authentic objects that are recently created. In South-America the preferences regarding the type of TK are not strong enough to be significant, but significant preferences to place ownership and initiative with the indigenous communities shows an active engagement of these groups. In line with this, South-American countries show a negative preference (or dislike) for placing the ownership of TK with the state. Similar to South-America, North-American countries show a preference for placing the initiative for protection with indigenous communities. African countries on the other side, show a significant preference for state ownership and initiative of TK. They show a significant preference for the protection of folklore. They also show significant dislikes for placing ownership with indigenous communities, and for placing initiative with either indigenous communities or with individuals. They also show significant dislikes for the protection of active commercial interests, and for the protection of sacred culture and traditional medicine. For both North-America and Europe there are no significant links between preferences of countries and their regions. Some of the lack of significant preferences can be explained by the relatively small number of states in the region that reported legislation.[92]

3.3.3. The three approaches to the protection of TK

When taking a closer look at the database, three different approaches can be crystalized in the various domestic preferences to TK protection, based on the correlation between variables. The purpose of the legislator to provide TK protection influences the specific form and way in which this protection is chosen to be provided. One can distinguish between these three purposes based on the forms of TK they are applied to, the type of interest they are aiming to protect, and the parties benefiting from the protection. As this distinction not only encompasses the underlying focus of the legislation, but also the way

[92] The sign and significance of these links are determined based on the correlation between the individual variables. Appendices and show the Karl Pearson Correlation coefficients and T-statistics of these variables, with indications for the significance levels of 5% and 1%.

the protection is made operational this distinction is referred to as the three approaches of TK protection, defining the three approaches as economic empowerment, preservative protection, and cultural integrity. Each of these approaches in the legislation have their own forms of TK that the protection is for, their own interests they aim to protect, and their own beneficiaries from the protection. Links between GDP and the preferences for specific ways of protecting TK could explain differences between countries, but also within regions. However no strong link between either of the three approaches and GDP has been found, only a significantly[93] positive correlation between GDP and the choice to place the initiative for protection with individuals, and a significantly negative correlation between GDP and the protection of folklore. Possible explanations could venture into the differences in legal public policy culture, or a view on an individual's role in society that might be linked to the underlying economic state or the developmental level of a country, for instance developed countries with high GDP tend to put an emphasis on the responsibility and role of the individual, and lesser developed countries might place a greater weight on the role and responsibilities of communities as a group. This again is linked to another factor; the need for TK legislation that creates economic value, which can be expected to be higher in countries with a low GDP. The presence of folklore in societies that have gone through industrialization relatively early is mostly lower, or plays a less important role than in less developed countries, which can explain the negative link between GDP and the protection of folklore.

An overview of the various factors making up the three approaches, as based on the correlations found between the various characteristics in the database, is given in Figure 5.

3.3.3.1. Economic empowerment

The first approach, economic empowerment mainly regards the protection of traditional medicine, active commercial interests are protected and the ownership of the TK and the economic benefits that can be derived from it are placed with individuals. The initiative to apply for protection is left to individuals and indigenous communities. This form of protection allows individuals to use TK for their own economic benefit. Such monetization of TK allows for economic empowerment of the holders of TK in society. In wealthier states, where the holders of TK are often the economically weaker individuals, this type of legislation is helpful for the emancipation of indigenous minorities.

[93] At a 1% significance level.

Figure 5. Three approaches for legislation on TK-protection

This qualification is based on the correlation coefficients between the variables.

	Economic Empowerment[94]	**Preservative Protection**[95]	**Cultural Integrity**[96]
Type of TK	Traditional medicine	Folklore authentic objects	Sacred culture historical objects and authentic objects
Interests Protected	Active commercial interests	Defensive commercial interests	Ethical concerns
Ownership	Individuals	State	Indigenous communities
Initiative	Individuals Indigenous communities	State	Indigenous communities

An example of a country that has legislation following the economic empowerment approach is India. India's Patent act declares any TK non-patentable[97]. This protects defensive commercial interests. The protection of traditional medicine is regulated in the drugs and cosmetics act and rules[98]. The traditional medicine that is regulated in this act is explicitly defined to pertain all Ayurvedic, Siddha and Unani drugs[99]. This act gives the central government, and a board appointed by the government, the powers to set standards and conditions for licensing schemes for the commercial manufacturing of the traditional medicine drugs[100]. The act prohibits commercial manufacturing of the specified drugs not

[94] The variables within the approach of Economic Empowerment have a significant correlation with one or more of the other variables in the approach. For the correlation coefficients and their respective significance levels, see appendix 3.4.

[95] The variables within the approach of Preservative Protection have a significant correlation with one or more of the other variables in the approach. For the correlation coefficients and their respective significance levels, see appendix 3.5.

[96] The variables within the approach of Cultural Integrity have a significant correlation with one or more of the other variables in the approach. For the correlation coefficients and their respective significance levels, see appendix 3.6.

[97] Art 3p, The patents act 1970, 39 of 1970, 19-9-1970, As amended by Patents Act, 2005 15 of 2005, 4-4-2005, India. As the act does not give any definition of TK, we have no reason to assume the definition TK is used in a context other than the definition as given by WIPO and used in this paper.

[98] Drugs and Cosmetics act 1940, 23 of 1940, 10-4-1940, As amended by the Drugs (Amendment) Act, 1955, the Drugs (Amendment) Act, 1960, the Drugs (Amendment) Act, 1964, the Drugs (Amendment) Act, 1972, the Drugs (Amendment) Act, 1982, the Drugs (Amendment) Act, 1986, and the Drugs (Amendment) Act, 1995, India.

[99] Art 3 of said act, and The First Schedule in the appendix to the act, given an elaborate lists of the books in which these drugs are described.

[100] Art 33N(2)(e).

in accordance with these rules[101]. These licenses allow individuals to pursue active commercial interests, and also protects defensive commercial interests at the same time. The government may also prohibit the manufacturing and sale of specific types of these traditional medicine drugs in the public interests, when a drug does not have the value therapeutic value claimed[102]. This protects ethical concerns. However specific individuals, namely Vaidyas (traditional Ayurvadic healers) and Hakims (traditional Unani healers) are exempt from these rules when they manufacture these traditional medicine drugs for their own patients[103]. The act does not give any hints as to when a person is qualified to be considered a Vaidya or a Hakim.

3.3.3.2. Preservative protection

The second approach, preservative protection, aims at preventing third parties from wrongly or offensively using folklore, and from falsely labelling newly created objects as authentic. Both the ownership of the folklore and the initiative is mainly put in the hands of the state, or in those of the population as a whole. This approach can be seen as protecting and preserving the identity of a state and its population for the future, with no direct aim on economically benefiting from the TK.

An example of legislation that follows the preservative protection approach can be found in Lithuania. Copyright law in Lithuania states that folklore works are not attributed to the subject matter of copyright[104], such that folklore cannot be copyrighted by anyone. The Law on the principles of state protection of ethnic culture[105] creates an active role for the government in the protection and stimulation of TK. Although the definitions[106] do not explicitly specify this, the law seems to be focussing on both historic[107] and newly created authentic objects[108], as well as folklore[109]. The main focus of this law is to ensure protection, and stimulation of TK, or "Ethnic Culture" as it is called in this law.

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[101] Art 33EEB.
[102] Art 33EEC and 33EED.
[103] Art 33EEC.
[104] Art 5.6 Law no. IX-1355, Law amending the law on copyright and related rights, 5 March 2003, Lithuania.
[105] Law no. VIII-1328, Law on the principles of state protection of ethnic culture, 21 September 1999, as amended by Law No. X-484, 9 January 2006, Lithuania.
[106] Art 2.
[107] Artt 2.1, 2.4, 2.6 and 2.9.
[108] Artt 2.1, 2.4, 2.5 and 2.9.
[109] The mentioning of Audio and video recordings of ethnic culture in art 2.1 of said law seems to imply the inclusion of folklore.

Concretely, to this purpose a Council for the Protection of Ethnic Culture is created[110], and various governmental organs are expected to also actively participate in the protection of Ethnic Culture, with the council[111]. In order to preserve and protect the mentioned TK, the Ministry of culture, science and education, shall ensure that the properties of ethnic culture are being accumulated and systematically collected[112], to keep them available for research, and for each individual who likes to acquaint him or herself with the material[113]. The gathering of this TK is initiated by a governmental organ; however there are also individuals involved whom this information is collected from. These individuals are defined as "presenters". It seems that in the letter of the law these presenters are purposefully not considered to be "owners" of the information they hold, but mere temporary holders of information handed down through generations. Even though the presenter is not considered to own the TK, upon collection of the TK, his permission is needed to fix and describe the information. How the information will be taken up in the collection if there is no permission for fixation is unclear from the law. Presenters also receive compensation if the presenter uses the information commercially. If the TK collected is an object, the presenter will also be compensated.

Use of the archival material is freely permitted for scientific and educational purposes, but not for commercial Even though the presenter is not considered an owner, his permission is needed for the commercial use of the TK, and he will receive compensation for such use. At the same time permissions is also needed from the compiler of the collection (which will be public organisations, archives, libraries etcetera), who also has the right to be compensated for use. So if not legally, for all practical commercial purposes both the presenter and the compiler are considered owners of the TK[114]. And the main purpose of the law is to prevent the loss of TK, and to prevent "wrong" use of TK in the eyes of the presenter and the compiler. The law further describes some activities that should help to promote the development and knowledge about Lithuanian TK.

[110] Art 5.1.1.
[111] See art 5.
[112] Art 6.
[113] Art 7.
[114] Art 7.

3.3.3.3. Cultural integrity

The third approach, cultural integrity aims at the protection of sacred and historical culture. The ownership and decision power in this approach is places with indigenous communities.

Regarding legislation falling under the cultural integrity approach, the copyright and related rights act[115] of the Island state of Vanuatu is a nice example. The copyright law of Vanuatu protects "Expressions of indigenous culture", which encloses the TK categories of historical objects[116], and sacred culture[117], but also authentic new objects[118], folklore[119], designs[120], and biological TK[121]. Nobody is allowed to reproduce, record, perform, publish or in any way communicate to the public, any of these TK forms[122], if they are not a custom owner, or have the authorization of a custom owner or of the Malvatu mauri (national council of chiefs of Vanuatu). The use also has to be in line with the custom use. This does not only apply to commercial use, but also to use not for profit.[123] This means that both defensive commercial interests and ethical concerns are protected. If it is not clear who the custom owners are, the Malvatu mauri is considered to be the owner[124]. As for most TK it is hard to find an identifiable creator, a customary owner is also quite hard to track down. This means that there is a relatively large part played by the Malvatu Mauri, who represent the indigenous communities of the islands.

3.3.4. How much of the legislation is explained by the theory of the three approaches?

To find the extent to which the theory of the three approaches explains the differences between the legislative choices made, a more elaborate statistical analysis of the dataset is useful. A factor analysis allows us to verify the validity of the theory of the approaches and to determine how much of the variance of the variables in the dataset the theory explains.

Factor analysis is a statistical technique, which models underlying factors, or latent variables, that influence the interdepency of variables. The factorloadings are linear

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[115] Copyright and related rights act no. 42 of 2000, 29 December 2000, Vanuatu.
[116] Art 1(1), under "expressions of indigenous culture" (a), of said act.
[117] Art 1(1), under "expressions of indigenous culture" (c).
[118] Art 1(1), under "expressions of indigenous culture" (a).
[119] Art 1(1), under "expressions of indigenous culture" (b) and (c).
[120] Art 1(1), under "expressions of indigenous culture" (d).
[121] Art 1(1), under "expressions of indigenous culture" (e).
[122] Art 41 (1) jis. 8(1) and 23(1).
[123] Art 41.
[124] Art 42 (1) to 42 (4).

combinations of the existing variables. These factors themselves can by either correlated or uncorrelated to each other, but influence visible data through their correlation with the variables. Each individual country is assumed to have an underlying preference for the factors, represented by their factor scorings.

The factors are modelled in such a way that the data matrix (X) holds the dependent variable, with the factor scorings of the countries as independent variables (F), and the factor loadings as the coefficients (W). The error term (ε) is minimized in the factor analysis.

$$\boldsymbol{X = FW + \varepsilon}$$

The basic difference between factor analysis and regression analyses lies in the fact that a factor analysis is done when the independent variables (countries' preferences for each of the three approaches) are unobservable, and therefore need to be deduced from the observable data, or the dependent variables, by maximizing the variance of the data that can be explained by the factors. The factor scorings are then predicted by minimizing the error matrix.

Factor analysis originated in psychometric research by Spearman[125], to show that underlying human capabilities, such as intelligence, that could not be measured and quantified as a variable in itself, could be distilled from how it influenced the scores of schoolchildren on an array of unrelated subjects. In this paper the factors are used to show support for the model with three underlying approaches determining the legislative choices of states when it comes to the protection of TK. Such that the observed legislative choices of a country can be explained by their underlying preferences for either a single approach, or a combination of approaches. [126]

This analysis is a confirmatory factor analysis, to see whether the data does not reject the theory of the 3 approaches.[127] The hypothesis we are testing (H1) is that the model of the theory of the three approaches explains (a part of) the covariance of the data for countries that have legislation on the protection of TK. The null-hypothesis, on which we would fall back if the H1 is rejected, is that the covariance is random. Subsidiary to H1 not

[125] Spearman (1904a and 1904b).

[126] To do a factor analysis, as a rule of thumb, it is advised to have at the very least 50 observations. The dataset discussed in this article does not fill that requirement, and therefore the results of a factor analysis may not be strong enough to make significant claims. However, despite the relatively small size of the dataset, factor analysis of the dataset does give interpretable results, and helps us to better understand the interaction of the variables within the three approaches.

[127] If one were to do exploratory factor analysis, no assumption on the underlying factor structure would be made a priori, and it would show from the analysis how many factors best explain the data.

being rejected the question is how much of the variance of the data is explained by the theory of the three approaches.

The results from the factor analysis is that H1 is not rejected, and that the theory of the three approaches explains up to 81% of the variance of the data. This means that the theory of the three approaches explains up to 81% of the legislative decisions made by the countries that have chosen to protect their TK. The following section gives a summary of the factor analysis. For a full step by step description of the factor analysis, see appendix 3.7.

3.3.5. Factor analysis

To simplify the dataset, three new variables are introduced: "rightholder state", "rightholder indigenous communities" and "rightholder individuals".[128] The results of the factor analysis of these simplified data: the factor loadings and eigenvalues of the factors, are shown in Figure 6 [129]. They show a factor 1 with positive support for the economic empowerment approach, and a negative support for the preservative protection approach. This means that countries with a high scoring for factor 1 are more likely than other countries to have legislation protection traditional medicine, that supports active commercial interests for both individuals and indigenous communities. These are countries with a relatively high GDP. The positive value for sacred culture does not fit directly in the economic empowerment approach. However, it are mainly the more wealthy South American countries that have legislation within the economic empowerment approach that also protects sacred culture.[130] A possible explanation could be that for South American indigenous communities traditional medicinal knowledge is sacred, or sacred knowledge is medicinal. Either way, the two seem to be more likely to coincide in wealthy South American regions than in other regions. Which leads to the conclusion that for those regions sacred culture should be included in the economic empowerment approach.

[128] A strong positive correlation exists[128] between a legislator's choice to place the ownership with a party, and to place the initiative for protection with the same party. This is resolved by creating a new variable, named 'rightholder state', with a value of 1 if a country has legislation placing either ownership or initiative with the state, and a value of 0 otherwise. In a similar way the two variables 'rightholder communities', and 'rightholder individuals' are created. Decreasing the number of variables to 13, without losing much of the information on the variation in the legislation.

[129] For a more elaborate explanation of the meaning of the results of the factor analysis, see appendix 3.7.1.

[130] See appendix 3.7.1.

Countries with a negative scoring for factor 1 are likely to have legislation following the preservative protection approach. They are likely to have legislation protecting folklore and placing all rights in the hands of the state.

Countries with a high scoring for factor 3 are also likely to follow the preservative protection approach. Their legislation protects authentic objects, folklore and designs, placing the rights with the state and protecting defensive commercial interests. The scoring of countries for factor 3 is independent of their GDP.

The split of the preservative protection approach between factor 1 and 3 allows countries that have a high score in factor 1 –countries following the economic empowerment approach– to also follow the preservative protection approach with a high scoring of factor 3. These countries are slightly more inclined to have legislation protecting authentic objects and design, than folklore, although this difference is marginal. The rights of the TK are placed with the state and defensive commercial interests are protected. An example of such a country is Panama, with a scoring of 1.24 for factor 1 and 2.06 for factor 3.

Factor 2 shows positive support for the cultural integrity approach and negative support for the economic empowerment approach. A country with a high scoring for factor 2 is likely to protect historical objects and sacred culture to protect them for ethical concerns. Countries with a negative scoring for factor 2 are likely to follow the economic empowerment approach, protecting active commercial interests of traditional medicine. These countries are also likely to protect defensive commercial interests at the same time. This is a slight deviation from the normal pattern seen in the economic empowerment approach, although the protection of active commercial interests and defensive commercial interests are not mutual exclusive. It are mainly Asian countries with a relatively low GDP that include defensive commercial interests in their legislation following the economic empowerment approach. In general countries with a relatively high GDP are more likely to have a high scoring for factor 2.

Figure 6. Principal factor analysis

Ownership and initiative have been combined and regions not included. Including factor loadings ≥0.38, and the factor loading for folklore in factor 3.

factor loadings and unique variances

variable	factor 1	factor 2	factor 3
Traditional medicine	0,558	-0,473	
Authentic objects			0,579
Historical objects		0,560	
Sacred culture	0,633	0.386	
Folklore	-0,537		0,374
Design			0,402
Rightholder state	-0,670		0,425
Rightholder communities	0,682		
Rightholder individuals	0,422		
Active commercial interests	0,580	-0,434	
Defensive commercial interests		-0,515	0,528
Ethical concerns		0,701	
ln(GDP)	0,414	0,444	

factor analysis/correlation

Method:		principal factors
number of parameters	=	76
Number of observation	=	35
Retained factors	=	8

Factor	Eigenvalue	Cumulative
factor 1	2,8460	0,3733
factor 2	2,0384	0,6406
factor 3	1,3099	0,8125
factor 4	0,8631	0,9257

The column named “cumulative” in Figure 6 gives the cumulative proportion of variance accounted for by this factor plus all of the previous ones. Together these three factors explain 81% of the variation in the dataset, meaning that 81 % of countries’ choices for either of the three approaches can be based on its scoring in factors 1, 2 and 3, as shown in figure 7, where these results are summarized.

Figure 7. The link between factor scorings and approach taken.

	A country's rating for factors	
	High	**Low**
Factor 1	Economic empowerment	Preservative protection
Factor 2	Cultural integrity	Economic empowerment
Factor 3	Preservative protection	-

Figure 8. Three approaches as supported by the factor analysis.

	Economic empowerment	**Preservative protection**	**Cultural Integrity**
Type of TK	Traditional medicine (and sacred culture for South American countries with low GDP)	Folklore (and authentic objects and design)	Sacred Culture, authentic objects and historical objects
Interest protected	Active commercial interests (and defensive commercial interests for Asian countries with high GDP)	Defensive commercial interests	Ethical concerns
Ownership	Indigenous communities	State (indigenous communities and individuals)	-
Initiative	Indigenous communities and individuals	State	-

Combining these results shows that the factor analysis supports the theory of the three approaches as presented in Figure 8. Statements in between brackets are only supported when the dataset is simplified; this is due to the relative small number of observations.

The individual scorings on these factors, tell us show us how strong countries' legislation follows the approaches. The country that scores highest on factor 1 is the Kyrgyz Republic, with a scoring of 2.22. A scoring of -1.42 in factor 2 for the Kyrgyz republic shows a strong preference for the economic empowerment approach. Combined with a scoring of 0.17, the legislation of the Kyrgyz Republic shows no interest in either the preservative protection approach or the cultural integrity approach.

Malawi is the lowest scoring country on factor 1, with a value of -1.03. Combined with a scoring of -0.6 in factor 2 and 0.12 in factor 3, Malawi shows a strong preference for the

preservative protection approach, and a mild interest in the economic empowerment approach.

The highest scoring country for factor 2 is Japan, with a scoring of 1.42, showing strong preferences for the cultural integrity approach. A scoring of -0.01 in factor 1, and -1.19 in factor 3 show that Japan have no other interests than that approach.

The country with the lowest score for factor 2 is Thailand, with -1.53, showing a preference for economic empowerment. A scoring of 0.18 for factor 1 and -1.43 for factor 3 shows that Thailand has no other interests than economic empowerment.

Scoring relatively high in both factor 1 and 2 is Australia, with 1.84 for factor 1 and 1.38 for factor 2. This means that Australia's legislation combines both a lot of elements from the economic empowerment approach and a lot of elements from the cultural integrity approach.

Panama, with a scoring of 2.06, has the highest scoring for factor 3. A scoring of 1.24 for factor 1 and -0.58 for factor 2 show that Panama has preferences for both economic empowerment and preservative protection.

Italy has the lowest score for factor 3, with -1.96. A scoring of 1.37 for factor 1 and -1.37 for factor 2 show that Italy has legislation in place following the economic empowerment approach.

Figure 9 shows the scorings of each country for factor 1 plotted against the scorings for factor 2.

Figure 9. Factor scorings for countries for factor 1 and 2.

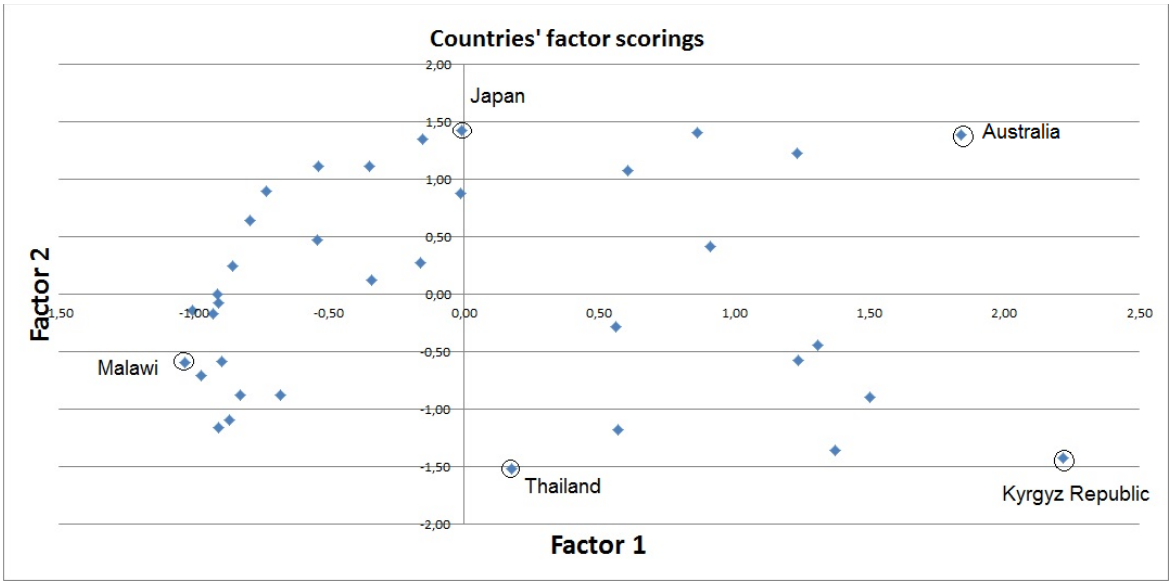
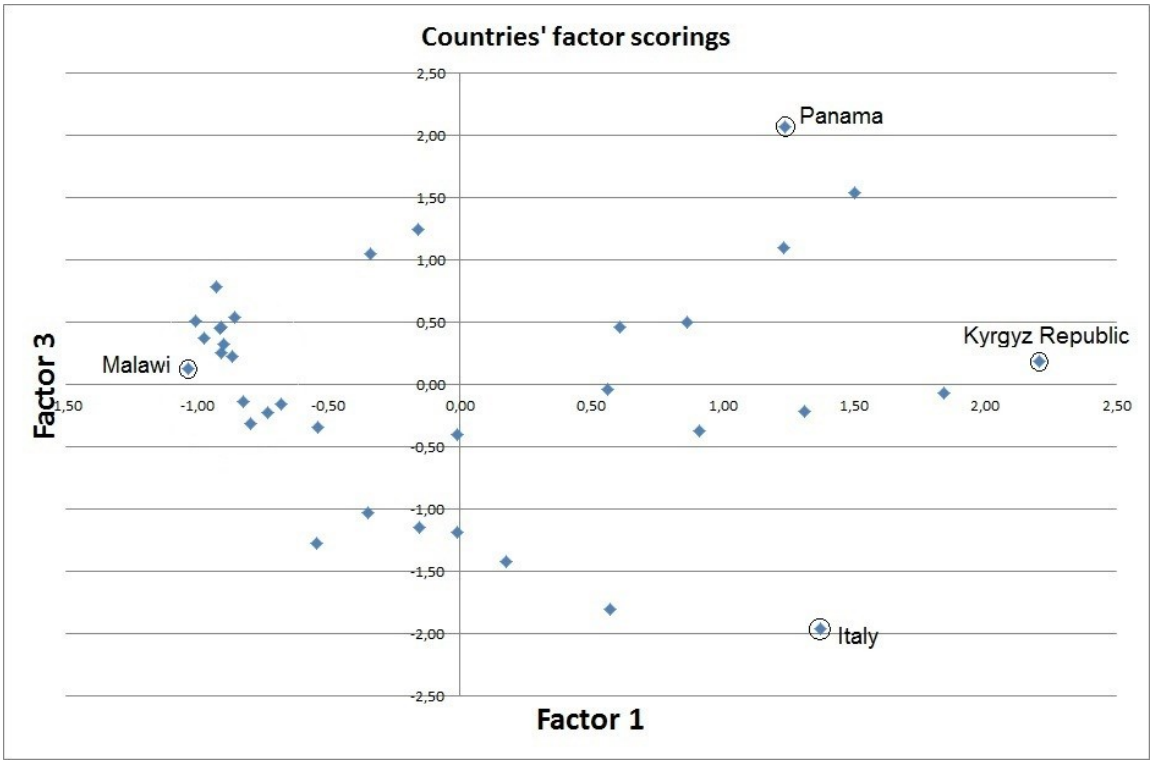


Figure 10 shows the scorings of each country for factor 1 plotted against the scorings for factor 3. The cloud of points that is grouped in the top left quadrant of the scatterplot, are countries that have a positive scoring for factor 3 and a negative scoring for factor 1. These countries are the most inclined to have legislation following the preservative protection approach. Of these 12 countries, 7 are African, 2 are Oceanian, 2 Asian, and the last one is Azerbaijan, which is situated on the border between Europe and Asia. The strong representation of African countries is in line with the conclusion that African countries show a stronger preference for preservative protection than other countries.

Figure 10. Factor scorings for countries for factor 1 and 3



3.4.Conclusion, discussion and further research

The overall conclusion of this paper is that the preferences of countries regarding their legislation on the protection of TK are indeed quite heterogeneous. However some similarities and trends can be found in the legislation, linking trends in preferences within and across regions, and with the development level of countries. Three approaches have been distilled from the dataset. An economic empowerment approach, which seeks to

create opportunities for the economically weaker indigenous groups in society to monetize on their TK. The legislation creates the possibility for indigenous communities to pursue active commercial interests for their traditional medicinal knowledge. South American countries with a relatively high GDP, and Asian countries with a relatively low GDP are likely to follow this approach. The preservative protection approach seeks to protect folklore for the benefit of the state or the country as a whole. This approach is found a lot in African countries, and outside of Africa one is more likely to find it in the legislation of countries with a relatively low GDP. The cultural integrity approach seeks to prevent the offensive and inappropriate use of sacred culture, historical objects and authentically created new objects. Legislation following this approach is most likely to be found in Oceanian countries with a high GDP, North American countries with a high GDP, or countries with a high GDP in general.

The theory of these three approaches explains up to 81% of all variation in the legislation that was reported to protect TK around the world.

An interesting question is what underlying differences explain this variation in TK legislation. Answers that spring to mind are related to the presence of TK in a jurisdiction, the political and economic position of indigenous communities, the number, size and diversity of these indigenous communities etcetera. Preliminary OLS analyses of the factor scorings on cultural diversity indices[131] and democracy indices[132] show no significant relation between these values[133]. Future research into explaining the variation in legislation could be valuable.

One limitation of this paper is that the dataset is based on the legislation that countries have reported to the WIPO. All WIPO states have been requested to report all their existing legislation on this subject. However, it is not unlikely that there are states that are members of the WIPO, and that have domestic legislation on TK protection, but that have failed to report this legislation to the WIPO. Unreported legislation has regrettably not been enclosed in this dataset.

Apart from the legal status of TK protection under the TRIPs auspices, also the de facto status of TK protection would be important to take into account, as the de facto protection

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[131] Fearon (2003).

[132] Economic Intelligence Unit, *Democracy Index 2011*, available at :http://www.sida.se/Global /About%2 0Sida/S%C3%A5%20arbetar%20vi/EIU_Democracy_Index_Dec2011.pdf

[133] With the exception of the factor scorings for factor 2, which show a positive significant link between the democracy index and the scoring for the cultural integrity factor. However this relation disappears when controlled for GDP.

might not always be similar to what the de jure protection. This might be even more so due to the discretion that is left to the national legislators when TRIPs standards are implemented in domestic legislation. Due to the scope of this paper the analyses of domestic legislation was limited to the de jure protection of TK only. The de facto protection is left for future research.

This paper has provided a first overview and insight in the diversity of legislation on the subject of TK protection. The conclusions drawn from this analysis of the dataset are possibly only the beginning. The findings of this paper could give insight in the possibilities, opportunities and feasibilities of regional and international agreements on the protection of TK, and might help to refocus the negotiations on platforms such as the WIPO and the WTO on the topic of TK. Future research could further develop the underlying factors influencing or explaining the preferences of countries regarding their legislation on TK. But also future research focussing on how international agreements could be shaped to best support the legislation within these approaches would be helpful.

4. The Way Forward for International Negotiations on the Protection of Traditional Knowledge

ABSTRACT

Past and current international negotiations on the protection of Traditional Knowledge (TK) have not been very successful. In this paper the potential reasons for this are analysed. This paper answers the questions of where the potential benefits lie of international frameworks of protection for TK, and what the challenges are in the formation of such agreements.

To answer these question the current legislation protecting TK is used as a proxy for the preferences of countries with respect to the various aspects of TK protection.

The analysis concludes that it might be worthwhile to invest in negotiations on the development of a sui generis right, allowing for active commercial rights of knowledge on traditional medicinal uses of products. For defensive commercial interests an international database listing the folklore that is in the public domain would suffice. To protect the cultural integrity of TK an agreement consisting of soft law and information sharing on the offensive use of sacred culture, and minimum standards on the use of emblems, names, and other denominations of indigenous communities would be effective.

4.1. Introduction

"On the 27th of January 2012, 20 Toi Moko – tattooed mummified heads – were returned to New Zealand from France after 200 years"[134]. The Toi Moko were gathered from various museums and one university throughout France. The Toi Moko are the heads of Maōri chiefs, tattooed with traditional patterns signifying the sacred ancestral background of the bearer. The legal difficulty with this repatriation lay in the fact that these Toi Moko were both human remains and objects of cultural value. In France a law had to be passed for the Toi Moko to be considered human remains, above them also being considered cultural artefacts, such that they could be repatriated to New Zealand.

The status of cultural artefacts is often precarious. It is the traditional knowledge (TK) and sometimes sacred value that is embedded within the artefacts that makes this topic a sensitive one. TK is a broad concept encompassing not only historical and sacred objects, but also new authentic objects, medicinal treatments, folkloristic dances and songs to name a few. Without protection TK is vulnerable to offensive use, unrightful appropriation or piracy. The protection of TK within the standard framework of Intellectual Property Rights (IPRs) is problematic, as discussed in Chapter 3, and various countries have created legislation to procure some form of protection for their country's TK. As the example of the Toi Moko shows, domestic legislation on national TK is futile when the TK is in possession of a party outside of the country's jurisdiction. In the case of the Toi Moko, ad hoc diplomacy brought the answer.

It has been noted that the importance of international approaches to the protection of TK is becoming more and more clear (Yu 2003, and Bodeker 2003), but that somehow these international approaches have not been very successful so far (Yu 2003, 2008, Arewa 2006). It is believed that a divide exists between developed and developing countries, with respect to the way in which this increased interest shows itself (Ghosh 2003, and Ntambirweki 2001). Developing countries have become more proactive in advancing TK as an issue to be dealt with on international forums[135]. Developed countries seem to be more inclined to either not consider TK such a pressing issue, or to deal with TK-protection in their own domestic legal systems[136]. There is a some literature discussing why international negotiations on TK protection are relatively unsuccessful so far (e.g.

[134] Report of 03-04-2012, UNESCO Office in Apia, available at http://www.unesco.org/new/en/apia /about-this-office/single- view/news/maori_heads_return_to_new_zealand_from_france _after_200_years/.

[135] For example: Venezuela in WT/GC/W/282 at the WTO.

[136] For example: Australia and the US: see grad (2003).

Dutfield 2001). However, there seems to be a lack of literature on whether or not an international agreement would be beneficial in the first place. This paper fills that gap by analysing the pros and cons of an international integral framework of TK protection, and a variety of international agreements that don't encompass all forms of TK, but narrow the scope on a subgroup of TK forms.

This paper analyses the benefits that could come from the development of international agreements on the protection of TK, and the challenges that could be faced in the process. This is done by taking a closer look at the various factors that influence the effectiveness and efficiency of rulemaking when it is done on an international level. By comparing the effects of these factors with the benchmark situation of purely domestic approaches to the protection of TK, the opportunities and challenges of an international approach are crystalized.

There have been several negotiating attempts at the creation of international frameworks for the protection of TK, with varying levels of success. These negotiations varied from global negotiations on the protection of all forms of TK, global negotiations on the protection of specific forms of TK, and regional negotiations on the protection of TK. These three forms of negotiations are discussed in section 4.3.

At the moment the debate on international agreements is dispersed and unfocused, trying to include as many forms of TK as possible. The stagnation of the negotiations are problematic for those countries who want to see an international agreement being formed. This paper contributes to the solution of that problem, by splitting up the whole TK matter into bite-size chunks, the three approaches that are discussed in the previous Chapter, and identifying in which chunks there is most to gain from an international agreement, and identifying for which chunks an international agreement would not create much value for its member states.

This is done by analysing the hypothetical situation that a group of countries forms an agreement on the protection of TK following one of the three approaches. The content of this agreement is described based on the assumption that each of the participating countries strives to form an agreement that suits their own revealed preferences as closely as possible, but that negotiating parties are limited by the need for consensus. In Chapter 3 the preferences of national legislators on TK protection were distilled from existing legislation using the categorization according to the three approaches. These revealed preferences, are taken as a proxy for the preferences on international negotiations on TK protection. The international framework that arises in this hypothetical situation is compared with the

current potential of national frameworks, based on effectiveness and efficiency in achieving the preferences of all countries involved.

The analysis concludes that it would be worthwhile to invest in negotiations on the development of a sui generis right, allowing for active commercial rights of knowledge on traditional medicinal uses of products. For preservative protection an international database listing the folklore that is in the public domain would serve the purposes of defensive commercial interests. To protect the cultural integrity of TK an agreement consisting of soft law and information sharing on the offensive use of sacred culture, and minimum standards on the use of emblems, names, and other denominations of indigenous communities would be effective and efficient.

In section 4.2 an explanation of the methodology is given. Also clarifications are provided on the definitions of some concepts as they are used in this paper. Section 4.3 discusses the various current international agreements and on-going negotiations on the protection of TK. Section 4.4 describes the content of international agreements in the hypothetical state of the world where negotiations are approach specific. Section 4.5 identifies the effects that various aspects have on the possible efficiency and effectiveness of the creation of international agreements, both if the agreement were to be done for a generic protection of TK, or if the agreements were done per approach individually. Building on this section 4.6 concludes where the opportunities and the challenges would lie for such agreements.

4.2. Methodology

This paper determines where the challenges and opportunities lie for international agreements on TK protection. To do so an analytical framework is introduced to identify these challenges and opportunities. On the basis of this framework a comparison is made between the hypothetical situation where an international agreement is created, which is to be implemented by the domestic legislators of the member-states, and the situation similar to the status quo where no international agreement is reached and all of the regulatory decisions and the implementation are left to national legislators. This hypothetical situation is described in section 4.4. The paper analyses how well the preferences of countries regarding the protection of TK can be fulfilled, in light of the various difficulties in creating regulation that achieves the preferred outcome. The paper takes the revealed preferences of countries as a proxy for their goals, and discusses how well these preferences can be fulfilled with the different regulatory processes.

For this comparison two more notions need to be introduced. The first notion is an indicator for the preferences of countries regarding the protection of TK. The second is a notion for which conditions to take into account to determine whether either of the situations is "good" at fulfilling the preferences.

As indicator for the preferences of countries, the three approaches found in Chapter 3 are used: economic empowerment, preservative protection and cultural integrity. Each approach reflects a grouping of properties of TK legislation, as they are found in the legislation that currently exists. These properties regard the type of TK to protect, which parties are to benefit from the protection and which type of interest is protected. As these preferences vary across countries, it differs per country how well an international agreement would be able to accommodate them. The analysis is therefore split up for each approach separately to determine where the challenges and opportunities lie for an approach-specific agreement on TK-protection. This means that when the analysis discusses the possibilities and challenges for an international agreement on the protection of one of these approaches, that it is assumed that such an agreement is tailored specifically to fit the needs within that specific approach. A second situation is considered in which negotiations are held for an agreement that catches all forms of TK protection, not distinguishing between the individual approaches and forms of TK. This situation is also hypothetical in the sense that the intentions of and communications between the participating countries are assumed to be clear, but it is largely based on the attempted direction of the current WIPO negotiations. This situation, where the negotiations encompass as broad a definition of TK as possible is called the generic TK approach.

The second notion regards the conditions to determine how well preferences can be accommodated in the two suggested situations. The first condition used is how effective a regulation is at achieving the goals as they are set for the regulation. The second condition is how efficient the process of creation and the implementation of a regulation is, under the given circumstances. Efficiency and effectiveness are commonly used concepts in policy and economics. To rule out any ambiguity in this paper these two concepts are defined as follows.

Efficiency is a one dimensional measure for the extent to which a function is performed with the least spending possible of time, effort and other costs, both financial and non-financial, including administrative costs, and information costs. The lower the spending, the higher the efficiency with which the function is performed.

Effectiveness is a one dimensional measure for the extent to which a preset goal is reached by the action performed to reach it. The smaller the distance between the actual outcome of an action and the preset goal, the higher the effectiveness of said action.

There are various aspects of the matter to be regulated, which pose challenges for the efficiency and effectiveness of the regulatory process. The key aspects taken into consideration are (i) potential gains from economies of scale; (ii) the possibilities and difficulties for a one-size-fits-all regulatory framework; (iii) the extent to which the type of TK is affected by cross-border aspects, such that either due to the mobility of the TK products, or to the mobility of the TK sources, TK can be removed from a national jurisdiction; the potential for a (iv) learning effect in regulatory processes for matters on which the knowledge regarding the effects of the various forms of regulations are still unclear, and effects of (v) economies of scope and (vi) diseconomies of scope.

The analysis will discuss the potential efficiency and effectiveness gains and losses stemming from each of these aspects of an international regulatory undertaking, broken down into each of the three approaches individually and a generic TK-approach, and compared to the benchmark situation of national regulations made by the domestic legislator. The size of the potential gains and losses are determined based on the characteristics of the specific approaches, such as the form of TK protected – for instance authentic objects or folkloristic dances - and how susceptible they are to the aspects - for instance due to the mobility of the specific form of TK.

The size of the gain or loss of efficiency or effectiveness is analysed in relative terms, based on the role the aspect would place within the approach. There is no comparison made between approaches regarding the sizes of the gains or losses. A simplified example might be of use here. Let's say we look at the aspect of cross-border effects. One of the characteristics that matter for this aspect is how mobile the products of TK are. The economic empowerment approach has a relatively large amount of the products are very mobile, and products that move across borders and leave the national jurisdiction. The effectiveness of any national regulation is compromised as soon as the products leave the jurisdiction. An international framework that works across borders will then have a relatively high effectiveness gain over national regulation. The preservative protection approach has relatively few mobile products The efficiency gain from an international framework is therefore relatively small. As we focus on potential for international agreements per approach, it is the relative size within the approaches that matters, and not the relative sizes between approaches.

When considering a situation of an internationally created framework of protection, it is assumed that the result is a compromise of the varying preferences of the participating countries. The effectiveness of legislation depends for a substantial part on the distance between the outcome of the regulatory process, and the preferred outcome of countries. For another part the effectiveness of legislation is affected by the dependency on other countries to reach the preferences of one country. So both the spread of the preferences, the predicted outcome, and the predicted countries to participate are taken into account. The latter is done by estimating the standpoint of the pivotal voter in the drafting process. Assumed is that international agreements are drafted on the basis of consensus, but that countries can choose to be a part to the agreement or not. The content of the regulation, in an international agreement can be binding law, but does not have to be so. The option of TRIPs-like minimum standards, with freedom for the member-states to provide a higher level of protection, and the option of non-binding agreements are also taken into account. It is assumed that when regulation is made on an international level, that the implementation is still left to the national legislator. How much freedom a national legislator will have in this implementation varies with the subject matter, content and goal of the agreement. This variation is also taken into account.

When considering a situation in which the regulation is created on a national level, it is assumed that the national legislator creates laws that fit the country's preferences, to the extent of the legislator's capabilities, so taking into account that the national legislator is limited to the domestic jurisdiction. This means that it is assumed that both the regulation making and the implementation of that regulation are done with the preferences of the country as a goal. This may seem utopic in certain, or maybe in all legal systems, but for the sake of the comparison this simplification steers the analysis away from strategic behaviour of individual actors within a political system, as these might be found both in a national regulatory system, as in an international system.

4.3.Current and past international negotiations

There have been several attempts at the creation of international frameworks for the protection of TK, with varying levels of success. There is the United Nations Declaration on the Rights of Indigenous Peoples. This is a non-binding document stating that indigenous peoples have the right to protect their TK and to develop IPRs over such TK.

TK is also part of the Doha Development Agenda[137] of the current WTO negotiations round, where the focus is on the relation between TK and the TRIPs agreement, in the light of developmental issues. At WIPO a committee[138] (IGC) is working on draft articles for the protection of TK, to serve as an example for countries looking to create legislation on the protection of TK. However, for various reasons, none of these efforts have yet led to the creation of a document that actually provides protection for TK. The processes and reasons behind this will be more elaborately discussed in section 4.3.1.

Also global agreements on the protection of selected forms of TK have been created. These endeavours seem to be more successful, leading to the creation of the Convention on Biological Diversity[139] (CBD), and the International Treaty on Plan genetic resources for Food and Agriculture[140]. These are discussed in section 4.3.2

Parallel to these global efforts to create international protection of TK, there are regional documents on the protection of TK, with varying degrees of success. These regional agreements regarding TK protection of the Pacific Community[141]; the Andean Community[142] and the African Union[143] are discussed in section 4.3.3.

4.3.1. Integral international agreements

The United Nations Declaration on the Rights of Indigenous Peoples[144], a non-binding document, states that indigenous peoples have the right to protect their TK and to develop IPRs over such TK. TK is also part of the Doha Development Agenda[145] of the current WTO negotiations round, where the focus is on the relation between TK and the TRIPs

[137] The Ministerial declaration of 20 November 2001 at the start of the Doha round negotiations, Paragraph 19 instructs the members to investigate the relationship between TRIPs (Agreement on Trade Related issues of Intellectual Property rights) and TK.

[138] Intergovernmental Committee on Intellectual Property and genetic resources, Traditional Knowledge and folklore.

[139] Adopted in, Rio de Janeiro on 5 June 1992 and entered into force on 29 December 1993. almost all existing states are members, except Andorra, the Holy See and the United States (which have signed, but not ratified the convention).

[140] Also known as the International Seed Treaty, adopted by the FAO Conference on 3 November 2001. This treaty is the successor of the International Undertaking op Plant genetic resources for Food and Agriculture of 1983.

[141] The Pacific Community has 26 members**:** American Samoa, Cook Islands, Federated States of Micronesia, Fiji, French Polynesia, Guam, Kiribati, Marshall Islands, Nauru, New Caledonia, Niue, Northern Mariana Islands, Palau, Papua New Guinea, Pitcairn Islands, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu, Vanuatu, Wallis and Futuna, Australia, France, New Zealand and the United States of America.

[142] The Community of Andean Nations consists of Bolivia, Colombia, Ecuador, Peru and Venezuela.

[143] The African Union is the successor of the Organisation of African Unity and consists of 54 African member-states.

[144] New York, 2007.

[145] The Ministerial declaration of 20 November 2001 at the start of the Doha round negotiations, Paragraph 19 instructs the members to investigate the relationship between TRIPs (Agreement on Trade Related issues of Intellectual Property rights) and TK.

agreement, in the light of developmental issues. No agreement has been reached yet in this negotiation round. At the WIPO a committee[146] (IGC) is working on draft articles for the protection of TK, to serve as an example for countries looking to create legislation on the protection of TK. However, for various reasons, none of these efforts have yet led to the creation of a document that actually provides protection of TK. The processes and reasons behind this are discussed below.

4.3.1.1. TK negotiations at the WIPO

Of all the existing international endeavours, the work by the IGC is the furthest, as it is the most directly focussed on an integral protection of TK. Although the work is far from complete, the IGC seems to have a clear picture of what is missing in their current knowledge and what work needs to be done to create a body of protection for TK. Established by the WIPO General Assembly in October 2000[147] the IGC is undertaking negotiations with the objective of reaching one or more agreements on the creation of an international legal instrument to ensure protection of TK, including what is referred to as traditional cultural expressions and genetic resources.

As can be seen in the mandate, the IGC splits up TK in 3 parts; 'genetic resources', 'traditional cultural expressions' and 'traditional knowledge'[148]. The latter is slightly confusing as TK is both the name of one of the parts, and also sometimes the term used for the 3 parts combined. To make things even more confusing traditional cultural expressions are sometimes called expressions of folklore, but the former term is used more commonly. The definitions of these three terms are currently still subjects of the negotiations and therefore constantly evolving. These changes in the wording, however, are minor, and do not majorly affect the content of the concepts. The term traditional cultural expressions encompasses both folklore and authentic authentic objects. Whether or not historical objects implicitly fall under this term is not entirely clear. However they are not explicitly excluded in the definition. All forms of expressions of folklore and genetic resources also fall under the definition of traditional knowledge, however there are some forms of traditional knowledge that do not fall under either expressions of folklore or genetic resources, such as medicinal knowledge, sacred knowledge and possibly historical objects.

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[146] Intergovernmental Committee on Intellectual Property and genetic resources, Traditional Knowledge and folklore.

[147] IGCs original mandate: WO/GA/26/6.

[148] The definitions of the concepts of genetic resources, traditional cultural expressions and traditional knowledge, as used by WIPO, are given in appendix 3.1.

This unclarity in distinctness between the concepts of traditional cultural expressions and traditional knowledge is still an unresolved issue among the negotiating parties[149]. The source of this problem lies in the fact that various members want different specific forms of TK covered in the definition, because they want these forms of TK to be protected, resulting in two definitions that are largely overlapping. The IGC has two parallel negotiation processes, one each for traditional cultural expressions and for TK. As is to be expected from the overlap in definition, these two negotiation processes have very similar, almost identical, contents and are evolving in a parallel manner, as is described below.

However not explicitly, from its actions it seems to be implied that the IGC is mainly doing work on the protection of traditional cultural expressions and TK. The IGC sees its role in the protection of genetic resources as more supportive to other agreements on genetic resources, such as the CBD. Although it has not yet succeeded in creating an international instrument for the protection of TK nor traditional cultural expressions, the IGC has done a substantial amount of preparatory work on the topic. It has created draft articles both for traditional cultural expressions[150] and for TK[151]. These were first published at the tenth session of the IGC in November 2006, and have been updated several times since. The draft articles are directed at protection on a national level, and are meant to serve as examples for countries who wish to implement national legislation of the sort. The IGC has done gap analyses for both traditional cultural expressions and TK, discussing the existing international accommodations, and what is still missing on an international level. These were completed and published in October 2008[152].

The main points of discussion, at the IGC's session of April 2012, regarding the issues of TK, were not much different from the original list of issues from 2006. The reasons for such a slow evolvement, or standstill if you will, in the negotiations, as noted by Ghosh (2012) is the "tension over the underlying policies for TK protection". He notes a three-way split in the underlying goals of TK protection. The first being the preservation of TK for future generations, the second being political and economic developmental goals for disadvantaged groups, and the third are goals such as the combating of biopiracy, environmental protection, biodiversity and health. These three show great similarities with

[149] WIPO/grTKF/IC/12/4(b) Annex, pp 27 – 30.

[150] The most recent version is WIPO/grTKF/IC/22/4 and dates from July 2012.

[151] The latest updates to the draft articles for TK are not published in official WIPO-documents at the moment of writing, but can be found at http://www.wipo.int/edocs/mdocs/tk/en/wipo_grtkf_ic_21/wipo_grtkf_ic_21_ref_facilitators_text.pdf.

[152] WIPO/grTKF/IC/13/4(b) Rev. for traditional cultural expressions and WIPO/grTKF/IC/13/5(b) Rev. for TK.

the three approaches from Chapter 3. Where Ghosh's first policy goal is similar to that of preservative protection, his second is similar to that of economic empowerment, and his third has more ethical concerns, just as cultural integrity.

In the view of the IGC, before the creation of an international instrument is possible there are several issues that still need to be dealt with. These issues were listed in 2006, at the tenth assembly of the IGC, and are still being discussed in the current negotiations[153]. Again the lists of issues are separate for traditional cultural expressions and for TK, but the contents of the issues, the comments and discussions are largely similar. The separation between the discussion on TK and on traditional cultural expressions is deceiving, as due to the broad definitions used and formulated, these are in fact two discussions on the same concepts. The issues show great similarities with the various aspects of protection in the theory of the three approaches, as discussed in the Chapter 3. As shown in Chapter 3, countries show varying preferences when it comes to the specific characteristics of TK protection. The WIPO's attempts at protecting TK, however, discuss the protection of TK as a whole and try to find agreement per aspect. It seems that this is where at least one of the main reasons lies of the failure to come to an agreement.

The discussion is ongoing on which forms of TK should be protected, the next issue is, whom the TK should be protected for, or who owns the TK. The next issue is what the TK should be protected against, et cetera. As the 3 approaches each have different answers to these questions, having such discussions per aspect, will never lead to any form of agreement. Figure 11 provides a simplified visualization of this problem. Per issue, or characteristic of protection, countries have made varying preferences in what they want for TK protection. Such that if the IGC tries to reach agreement on which forms of TK to protect, some countries will want to include traditional medicine, some will want to include folklore, and some will want historical objects, recent objects and sacred culture. But none will want to agree to either or all of these forms. The same goes for the other aspects, such as ownership of TK and interests that should be protected. In other words similarities in characteristics of TK protection have been found to exist in the national legislation – shown vertically in Figure 11- but the IGC is trying to reach an agreement per characteristic – shown horizontally - and is not succeeding. However, with the realization

[153] WIPO/grTKF/IC/12/4(b) for traditional cultural expressions, and WIPO/grTKF/IC/12/5(b) for TK, for an overview of the discussion of the issues, and the comments made by members and observers, from 2008.

of the existence of the 3 approaches less dispersed and more approach-specific negotiations would create the possibility to reach agreements.

Figure 11. Issues of TK protection.

Issues of TK protection	Economic empowerment	Preservative protection	Cultural integrity
Which TK?	Traditional medicine	Folklore	Sacred culture, authentic objects and historical objects
Who owns TK?	Indigenous communities	State	-
Which interests to protect?	Active commercial interests	Defensive commercial interests	Ethical concerns

4.3.1.2. TK negotiations at the WTO

The TRIPs agreement forms a minimum framework for IP protection, to which the 155[154] WTO members have to comply[155]. All WTO members are required to grant patents and copyrights, according to the TRIPs regulations. The TRIPs agreement provides minimum levels of protection that member-states have to provide, and individual member-states may decide to provide higher levels of protection if they wish to do so. The TRIPs agreement makes that IP already is an international topic, and therefore it is only logical to investigate to what extend various forms of TK protection would fit within the TRIPs framework. The dissatisfaction of some member-states with the current TRIPs framework, evolving around the economic effects for developing countries will not be discussed in this section, but is be briefly touched upon in section 4.5.6. This debate is part of the on-going negotiations regarding the TRIPs agreement, discussing the possibilities of TK protection, and the need for adjustments to TRIPs to accommodate for TK. The statements made by the various member-states of the WTO in this respect give a good overview of the various standpoints that countries from around the world take on this topic.

Paragraph 19 of the Doha-Declaration[156] instructs the Council for TRIPs to examine the relationship between the TRIPs agreement and the protection of TK and folklore. This

[154] Last updated May 2012.
[155] For selected member-states an extended deadline for compliance with the TRIPs is allowed.
[156] WT/MIN(01)/DEC/1, *Ministerial declaration* adopted on 14 November 2001, WTO ministerial conference fourth session Doha, 9-14 November 2001.

has led to a heated debate and a vast amount of country communications on this topic in general, and more specifically related to the review of art 27(3)b of TRIPs[157]. This discussion focuses mainly on the relationship between patent-related TK and TK protection. This is the IP area where TK encounters the most difficulties due to the requirements of patents discussed in Chapter 3.

In this section the various points of view will be discussed, that have been advanced by the WTO member-states in the Doha-negotiations round regarding TK and TRIPs. These discussions can be split into two topics: concerns about the current state of protection of TK, in section 4.3.1.2.1, and the need for international protection of TK, in section 4.3.1.2.2.

The main conclusion one can draw from these discussions is that within the member-states of the WTO there is currently not enough willingness to reach consensus on a form of protection for TK, above and beyond the protection provided by the minimum standards of TRIPs. This has two reasons. The first is the fact that these discussions are a part of the larger Doha negotiations round, and that a multitude of subjects are being discussed in this round. Any consensus reached would most likely have to be a package deal of all these subjects combined, and hence does not rely solely on consensus on the subject matter of TK. A second reason is the wide dispersion between opinions on the needs for the protection of TK, and the need for such protection to be incorporated in the TRIPs framework.

4.3.1.2.1. Concerns about the current state of TK protection

Not surprisingly concerns about the current state of TK protection, as discussed in the Doha-round negotiations, show great similarities with the discussions at the WIPO. The three types of interests used at the WIPO are grouped together at the WTO in two types of concerns expressed in the Doha negotiations: The first concern the granting of patents or other IPRs covering TK to persons other than those indigenous peoples with whom the TK has originated (this is similar to the defensive commercial interests discussed in Chapter 3, although possible solutions could entail the protection of active commercial interests as well). The second concern is about TK that is being used without authorization of the indigenous peoples with whom the TK originated, and without proper sharing of the

[157] An elaborate summary of the issues raised in this debate can be found in IP/C/W/370/Rev.1, 9 March 2006, Council for Trade-Related Aspects of Intellectual Property Rights, *The protection of traditional knowledge and folklore summary of issues raised and points made*, note by the Secretariat, Revision.

benefits from such use, here the first part can be interpreted to show ethical concerns, and the second part can be seen as regarding defensive commercial interests. The goals for protection, as discussed in the Doha round, are similar to those discussed at the WIPO. This section will therefore use these goals as a starting point when discussing the current Doha negotiations.

The concerns regarding the granting of patents to others than the holders of TK, show that there might be some areas where the current system of IPRs is not working well enough. Two specific points were advanced. The first points regards the novelty standard for patentability. India[158] and Kenya[159] note that not all members recognize information available through oral traditions, or information in the public domain outside their jurisdictions. This can result in patents being granted for knowledge that was not novel, but existed in oral form only. A second concern points out that instances of wrongly granted patents show that the patent examiners do not have adequate information on prior art in other countries[160], that it often only exists in oral form, and/or that it is available only in languages that the patent authorities do not master[161]. TK is a form of knowledge that is typically based in oral tradition, and therefore particularly vulnerable to misappropriation through patent examiners not aware of its existence or not taking it into account due to its form. These concerns have been countered with the argument that the criteria for patentability, when properly applied, avoid such erroneous granting of patents[162], which would make this a de facto issue, but not a de jure issue.

The US[163], Japan[164] and the EU[165] have argued that erroneously granted patents can be remedied by post-grant opposition or re-examining proceedings. The EU[166] refers to the revocation of the patents for agricultural use of Neem (see Arewa 2006) and Turmeric (see Bellman et al. 2003), as examples that revocation can be a successful mechanism. This

[158] IP/C/M/39 para 122, IP/C/M/28 para 126.
[159] IP/C/M/28 para 141.
[160] US in IP/C/W/209; and Switzerland in IP/C/W/284.
[161] Brazil in IP/C/M/48 para 37; India in IP/C/M/39 para 123; EU in IP/C/M/32; and Switzerland in IP/C/M/30 para 164.
[162] Switzerland in IP/C/M/30 para 164. Japan noted that prior art comprises all information that is publicly known anywhere in the world in IP/C/W/236. The US noted that patent applicants can be required to disclose information which is material to patentability in US IP/C/W/449, IP/C/W/434, IP/C/M/49 para 105, and IP/C/M/48 para 33.
[163]IP/C/W/449, IP/C/W/434, IP/C/M/49 para 105, IP/C/M/48 para 33, IP/C/M/46 para 35, and IP/C/M/32 para 131.
[164]IP/C/M/48 para 76, and IP/C/M/29 para 157.
[165] IP/C/W/254.
[166] IP/C/W/254.

argument has been countered by some Latin-American[167] and Asian[168] countries, with the argument that such opposition possibilities are insufficient, as they can be economically infeasible especially for developing countries. The two named examples of Turmeric and Neem were cases where the engagement of governments and non-governmental organizations made the challenging of the patents possible. For post-grant opposition to be a feasible remedy, indigenous peoples would have to keep track of all patents granted world-wide, to see if one infringes upon the rights of their TK. Due to financial, economical, and time constraints, this seems an unrealistic expectation. This factor decreases the de facto protection that indigenous peoples are offered with the possibility of opposition to wrongly appropriated TK by third parties. Even though de jure it does exist, the high transaction costs create barriers too great for indigenous peoples to actually use their rights. To which extent this is a problem is hard to assess, as there is no data on situations where indigenous peoples could have acted but did not do so. A deeper investigation of such occurrences would be very valuable to assess the de facto protection that currently exists for TK.

Various member-states[169] have suggested that this problem of the erroneously granting of patents could be prevented with the development of a database on TK, so that examiners of patent applications can easily access information regarding prior art. Various domestic starts have been made on databases regarding specific topics[170]. An electronic[171] database that is easily accessible over the internet[172] containing TK already in the public domain, or TK for which prior consent has been granted[173] would enable patent examiners to properly apply the existing criteria of patentability. Concerns over such a database involve the costs

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[167] Bolivia in IP/C/M/48 para 83, Bolivia et al. in IP/C/W/403, Brazil in IP/C/M/48 para 37, and IP/C/M/39 para 126, Brazil et al. in IP/C/W/356, and Peru in IP/C/M/46 para 51, and in IP/C/M/43 para 44.

[168] India in IP/C/M/48 paras 51 and 56, and in IP/C/M/46 para 42, Indonesia in IP/C/M/36/Add.1 para 217, and Pakistan in IP/C/M/36/Add1 para 211.

[169] The African group in IP/C/W/404, Brazil in IP/C/W/228, and IP/C/M/37/Add.1, para 255, Bolivia et al in IP/C/W/403, China in IP/C/M/36/Add.1, para 228, EU in IP/C/W/383, IP/C/M/43, para 39, IP/C/M/40, para 94, IP/C/M/37/Add.1, para 242, and IP/C/M/32, para 137, India in IP/C/M/37/Add.1, para 253, and IP/C/W/198, Japan in IP/C/M/48, para 76, and IP/C/M/32, para 142, Korea in IP/C/M/49, para 121, Switzerland in IP/C/W/400/Rev.1, IP/C/W/284, IP/C/M/42, para 98, and IP/C/M/30, para 164, The US in IP/C/W/449, IP/C/W/434, IP/C/W/257, IP/C/W/209, IP/C/M/48, para 33, and IP/C/M/46, para 34, Venezuela in IP/C/M/37/Add.1, para 243, and Zimbabwe in IP/C/M/36/Add.1, para 201.

[170] The four reported databases are: the Traditional Knowledge Digital Library in India, the Traditional Chinese Medicine Patent Database in China, the Register on Traditional Knowledge in Agricultural Products and Food in Austria, the United States of America Database of Native American Insignia.

[171] Switzerland in IP/C/W/400 Rev.1. and IP/C/W/284.

[172] Switzerland in IP/C/M/42, para 98 and IP/C/M/30 para 164, and the US in IP/C/W/434.

[173] Brazil in IP/C/M/37/Add.1, para 255, Bolivia et al in IP/C/W/403, and Venezuela in IP/C/M/37/Add.1, para 244.

of maintaining the database[174], possibly enabling piracy[175], and difficulties with oral or constantly evolving TK. The African group[176] and India[177] voiced strong rejections of the obligatory considering of such a database by patent application examiners.

Brazil[178], India[179] and Pakistan[180] noted that while such a database may help to prevent the granting of inappropriate patents, it will not solve the issue of the sharing of benefits resulting from the use of TK. This is true, but it would on the other hand, make the sharing of benefits easier, as it would at least shed some light on whom the benefits should be shared with. The EU points out that national regulations of prior consent and benefit-sharing are allowed under the current TRIPs system.[181]

To solve the issue of prior consent of the rightful owners of TK, and the sharing of benefits flowing from the use of TK with the rightful owners, several suggestions have been made. The suggestions made followed either one of four forms: bilateral contracts, disclosure requirements, using the existing IPR systems and the development of a sui generis IP right for TK.

The US[182] suggested that bilateral contracts between the rightful owners of TK and individuals using that TK, would be best to address the concerns raised. This way the contract could be specified to the specific needs of the individuals and communities involved, and the TK at hand. National legal systems should be able to provide enough security for the upholding of such contracts.

European countries [183] suggested disclosure requirements, which require the applications of patents to elaborate on the source of the TK associated. Such disclosure requirements are broadly supported[184] to include evidence of prior consent obtained from

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[174] Venezuela in IP/C/M/37/Add.1, para 244.

[175] Brazil in IP/C/W/228, IP/C/M/37/Add.1, para 255, IP/C/M/32, para 130, and IP/C/M/28, para 136, India in IP/C/W/198, and IP/C/M/29, para 164,and 165, and Venezuela in IP/C/M/37/Add.1, para 244, and IP/C/M/32, para 136.

[176] IP/C/W/404.

[177] IP/C/M/45, para 20.

[178] IP/C/W/228 and IP/C/M/32 para 130.

[179] IP/C/M/29 para 164.

[180] IP/C/M/28 para 159.

[181] IP/C/W/254.

[182] IP/C/W/434, IP/C/W/393, IP/C/W/341, and IP/C/W/257.

[183] Switzerland in IP/C/W/433, IP/C/W/423, and IP/C/W/400/Rev.1, and EU in IP/C/383, IP/C/M/44, para 29, IP/C/M/42, para 107, and IP/C/M/37/Add.1, para 228.

[184] African group in IP/C/W/404, Andean Community in IP/C/M/37/Add.1, para 231, Brazil in IP/C/M/32, para 128, IP/C/M/33, para 121, IP/C/M/36/Add.1, para 219, IP/C/M/37/Add.1, para 205, 237-238, IP/C/M/38, para 230, IP/C/M/39, para 126, IP/C/M/42, para 101, IP/C/M/46, para 81, and IP/C/W/228, Brazil et al. in IP/C/W/356, Bolivia et al. in IP/C/W/403, China in IP/C/M/43, para 56, IP/C/M/42, para 119, IP/C/M/37/Add.1, para 229, and IP/C/M/36/Add.1, para 228, Colombia in IP/C/M/46, para 57, IP/C/M/40, para 127, and IP/C/M/36/Add.1, para 209, India in IP/C/M/45, para 25, IP/C/M/40, para 81, IP/C/M/39, para

the competent authority in the country of origin of the TK, and the existence of appropriate benefit-sharing arrangements.

Exploring the possibilities of TK protection within the existing IPR framework was suggested as the most logical starting point when considering TK protection.[185] Combining the various existing forms of IPRs and other national legislation can create a good fit for the various forms of TK[186]. This way indigenous peoples have the possibilities for positive commercial protection, defensive commercial protection, and the protection of ethical interests, and also compel the sharing of benefits of individuals that do use their TK. Examples given by Australia[187] include jurisprudence that showcases a flexible use of copyrights applied to ancient spiritual rock images, and ancient cultural clan images. The reproduction of an Aboriginal artist's work embodying clan design, without his authorization, on pieces of fabric, shows how protection of industrial designs can protect TK. Australia also mentions her trademarks by indigenous arts centers as a form of TK protection. New Zealand[188] refers to its system of trademark certification, which works like a national label of authenticity for art of the Māori. The US[189] point out that trade secret law is very suitable to limit the circulation of TK by indigenous peoples. Possibilities of TK protection through geographical indications have been mentioned[190], for products originating from a specifically defined area. Objections or limitations to the use of the existing IPR framework come from Brazil[191] and India[192]. They point out that there might be issues due to the fact that TK is mostly owned by communities and not individual; that it may not meet the criterion of novelty; that problems might arise when multiple indigenous peoples hold the same TK; and that indigenous peoples often lack the resources to use the existing IPR framework.

The discussion regarding the possibility of TK protection through a sui generis system mainly regards the lack of consensus on a definition, which is essential for the

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122, IP/C/M/36/Add.1, para 214, IP/C/M/24, para 81, and IP/C/W/195, Indonesia in IP/C/M/36/Add.1, para 217, Kenya in IP/C/M/42, para 114, and IP/C/M/37/Add.1, para 239, Pakistan in IP/C/M/36/Add.1, para 211, Peru in IP/C/W/447, and IP/C/M/43, para 45, Thailand in IP/C/M/42, para 105, Venezuela in IP/C/M/40, para 102, and IP/C/M/36/Add.1, para 208.

[185] Australia in IP/C/W/310, and Japan in IP/C/M/29, para 157.

[186] Australia in IP/C/M/28, para 152, and US in IP/C/M/37/Add.1, para 250.

[187] IP/C/W/310.

[188] IP/C/M/37/Add.1, para 248.

[189] IP/C/W/257.

[190] EU in IP/C/W/254 and IP/C/M/43, South Africa in IP/C/M/43, para 66; Venezuela in IP/C/M/43 para 50 and IP/C/M/32, para 136.

[191] IP/C/M/37/Add.1, para 255, and IP/C/W/228.

[192] IP/C/W/198.

establishment of an international sui generis right.[193] Singapore points out that one needs to keep in mind the differences between TK developed by industrial and by non-industrial communities[194]. It is possible that protection of TK turns out to limit other IPRs, which fall under the minimum standards of TRIPs. For example, TK protection can limit the provision of patents and trademarks that violate the TK. In the discussions of the member-states, it is their opinion that nothing in the TRIPs agreement has been found to prevent countries to set up a sui generis right for TK in their national legislation[195], specifically article 1.1 TRIPs allows member-states to establish more extensive protection than the protection obligatory under the TRIPs agreement.[196] The EU supports the idea of an international model for such legislation.[197] The African group suggested the Model Law of the Organization of African Unity[198] as a basis for further discussion on a sui generis right.[199] They would like to see the WTO to arrange the development of such a sui generis right.

4.3.1.2.2. The need for an international approach to TK protection

Another issue discussed in the Doha negotiations is whether the protection of TK should be provided through international action. Most of the arguments that were given in favour of international action support the development of some form of TK protection, but do not show the necessity to do so through international cooperation. Such arguments include equity between indigenous peoples and other groups within a society[200], food security by protecting the practices of local farming communities[201], the protection of valuable culture[202], conservation of the abilities of indigenous peoples to operate in an

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[193] EU in IP/C/M/43, para 41, and IP/C/W/383, Japan in IP/C/M/36/Add.1, para 226, and IP/C/M/29, para 157, New Zealand in IP/C/M/37/Add.1, para 246, Switzerland in IP/C/M/40, para 73, Thailand in IP/C/M/42, paras. 105, 115, and US in IP/C/M/37/Add.1, para 250.

[194] Singapore in a non-written contribution as referred to in IP/C/W/370/Rev.1 para 34 and, footnote 137.

[195] Bangladesh in IP/C/M/42, para. 102, EU in IP/C/M/43, para. 39, and IP/C/W/254, Malaysia in IP/C/M/40, para. 128, and Zimbabwe in IP/C/M/36/Add.1, para. 201.

[196] Art 1.1 TRIPs: "(…) Members may, but shall not be obliged to, implement in their law more extensive protection than is required by this Agreement, provided that such protection does not contravene the provisions of this Agreement. (…)"

[197] IP/C/W/254.

[198] OAU Model Law, Algeria, 2000 – Rights of Communities, Farmers, Breeders and Access to Biological Resources.

[199] IP/C/W/404.

[200] Bolivia et al in IP/C/W/165, Cuba et al. in IP/C/W/166, Peru in IP/C/W/447, and IP/C/M/48, para. 18, and as well India in IP/C/M/28, para. 128.

[201] African group in IP/C/W/206, Kenya in IP/C/M/28, para. 142, and Peru in IP/C/M/29, para. 175.

[202] African group in IP/C/W/404, Bolivia in IP/C/M/38, para. 246, and IP/C/M/37/Add.1, para. 241, India in IP/C/M/28, para. 125-127, and IP/C/M/25, para. 70, and Peru, IP/C/W/447, IP/C/M/48, para. 18.

environmentally sustainable way[203], and the notion of TK stimulating economic development through enabling commercial potential to blossom[204]. Regarding the latter: it is not contested that protection of TK can contribute to achieving development objectives[205]. Development can be seen as an international goal (for instance the UN Millennium development goals), but this alone is not an argument that the goal can be achieved through international channels more effectively than through national arrangements. Possible arguments in favour of international action could be that these goals are easier achieved when they are approached for multiple countries together and the costs of the development of the TK protection (e.g. the setting up and maintaining of TK databases) is shared. This could take part of the costs away from developing countries. However, such global redistribution arguments were not expressed in the Doha negotiations.

Other arguments in favour of an international approach to this issue were:

- The absence of an international mechanism could undermine any national and regional laws that acknowledge collective rights of indigenous peoples over their TK.[206]
- The misappropriation of TK often is a cross-country endeavor: acquiring TK in one country and apply for patents in another country, where the TK is less well known. Whether this is allowed depends on the laws of the country where the patent application is made, therefore national legislation cannot provide protection of TK of its indigenous peoples when it is used in a foreign country: this will have to be done by that foreign country.[207]

Counter-arguments against an international endeavour to develop TK protection included:

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[203]Ecuador in IP/C/M/30, para. 184.

[204]In country communications: Brazil, IP/C/W/228, India, IP/C/W/198, Peru, IP/C/W/447, Switzerland IP/C/W/284.In council meetings: IP/C/M/28, para 136 (Brazil), IP/C/M/30, para 184 (Ecuador), para 153 (Peru), IP/C/M/32 para 134 (Indonesia), para 136 (Venezuela), IP/C/M/37Add.1 para 241 (Bolivia), para 254 (Kenya), Peru IP/C/M/48 para 18 (Peru), IP/C/M/49 para 82 (Peru).

[205] IP/C/M/29, para 201 (Venezuela).

[206]African group in IP/C/W/404, Bolivia et al.in IP/C/W/403, China in IP/C/M/40, para. 120, Ecuador in IP/C/M/30, para. 184, and Peru, IP/C/W/447, IP/C/M/48, para. 18.

[207]African group in IP/C/W/404, Brazil in IP/C/M/46, para. 79-81, IP/C/M/37/Add.1, para. 238, and IP/C/M/36/Add.1, para. 220, India in IP/C/M/48, para. 49, IP/C/M/46, para. 38, IP/C/M/45, para. 25, and IP/C/M/37/Add.1, para. 223, Indonesia in IP/C/M/36/Add.1, para. 217, Kenya in IP/C/M/42, para. 114, Pakistan in IP/C/M/36/Add.1, para. 211, Peru in IP/C/M/46, para. 50, IP/C/M/40, para. 84, and IP/C/M/36/Add.1, para. 203.

- The protection of TK is already provided through current national legislation. And national legislation provides this protection immediately. International processes are slower and cannot provide protection as immediate as national legislation.[208]
- The statement that there is no evidence that national regimes are insufficient to deal with wrongfully awarded IPRs over pre-existing TK to others than the rightful owners of that TK has also been put forward.[209]
- The potential of a learning experience the international community can have from a situation where various national regimes developing forms of TK protection independently can help to determine areas of inadequacies, and makes it possible to conduct cost-benefit analysis regarding such regulation[210]. This will lead to better equipped national legislation, than would an internationally developed system.
- The comment was made that international regimes can only work if they are supported by national regimes[211]. Therefore national regimes need to be developed anyway. There is no need to wait for international systems to develop.

So, concluding from the negotiations in the Doha round, one sees that Western countries that have indigenous peoples in their countries are in favor of TK protection within the existing IP framework. These countries already have established such TK protection within their own national frameworks. And countries where the indigenous peoples are known to have less resources than in these aforementioned Western countries (for instance Brazil and India) are critical of the appropriateness of the current IP-framework to accommodate for TK, partly due to the resources constraints of indigenous peoples. Most of the arguments in favour of an international framework for TK protection come from Latin-American, Asian and African countries, while the arguments against such a framework stem from Western countries.

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[208] US inIP/C/M/37/Add.1, para. 250.

[209] Australia in IP/C/M/46, para. 65, and IP/C/M/40, para. 101, Canada in IP/C/M/47, para. 66, IP/C/M46, para. 55, and IP/C/M/40, para. 115, Japan in IP/C/M/46, para. 77, New Zealand in IP/C/M/47, para. 54, and IP/C/M/46, para. 61, Switzerland in IP/C/M/47, para. 75, and US in IP/C/W/434, IP/C/M/47, para. 48, IP/C/M/46, para. 36, and IP/C/M/43, para. 55.

[210] Australia in IP/C/M/42, para. 118, and IP/C/M/40, para. 99-101, and US in IP/C/W/449, and IP/C//M/48, para. 30.

[211] New Zealand in IP/C/M/49, para. 118-119.

According to Dutfield (2001) it is debatable whether the latter point can be at least partially explained by the fact that wrongful use of TK by parties other than the rightful owners is often done by transnational corporations that are based mainly in the US. He suggests that developing countries have another agenda by making this issue a part of the Doha-round negotiations. The TK issue is used as leverage in the negotiations on an IP framework that is based on the historic development of western ideas. Dutfield describes the complexity of the TK issue and the high unlikeliness that TK will soon be incorporated in TRIPs, explaining these are signs that TK is used to deflate pressure on developing countries for compliance to TRIPs. Whether such underlying reasons exist or not is hard to determine, and not that relevant for the current discussion. It does show, however, that it can be very informative to figure out at which forum – national or international - the goals of TK protection can best be achieved.

4.3.2. Global negotiations on the protection of specific forms of TK

For the protection of biological knowledge, international treaties have arisen to form a sort of stepping stone towards the creation of fully fledged legal instruments. There are three such international treaties protecting biological knowledge:

- *Interlaken Declaration on Animal genetic resources*[212], which discusses the desirability of protecting TK concerning animal breeding. The Interlaken declaration does not create any form of protection per se, but works as a signal to put the issue on the map for national legislators.
- The FAO[213] *International Treaty on Plan genetic resources for Food and Agriculture*[214] (FAO treaty) protects TK that is relevant to plant genetic resources for food and agriculture. This treaty is the successor of *the International Undertaking on Plant genetic resources for Food and Agriculture* (1983), which assumed that genetic resources were the common heritage of humanity. The FAO treaty urges its member-states to take measures to protect genetic resources and provide for equitable sharing. Although this treaty is very specific in its topic, it again merely urges to take measures without discussing

[212] Adopted by the International Technical Conference on Animal genetic resources for Food and Agriculture on September 7 2007.
[213] Food and Agriculture Organization of the United Nations.
[214] Also known as the International Seed Treaty, adopted by the FAO Conference on 3 November 2001.

the actual measures, as it is for each individual country to decide on their own what is appropriate for that country given their specific circumstances.

- *The Convention on Biological Diversity* (CBD)[215] is related to biological knowledge, involving conservation and sustainable use of biological diversity. Contracting parties are expected to protect innovations and practices of indigenous peoples and local communities that are relevant for the conservation and sustainable use of biological diversity and enable the equitable sharing of the benefits arising from such TK. The CBD creates binding obligations, but leaves broad discretion to national legislators regarding the implementation[216]. This treaty is meant to be read together with the *Bonn guidelines on Access to genetic resources and Fair and Equitable Sharing of the Benefits Arising Out of Their Utilization*, which are non-binding recommendations to CBD member-states.

After the CBD was established in 1992, the CBD and the FAO treaty seemed to contradict each other (Downes 2000), as the CBD assigns genetic resources to the national governments, and the FAO treaty assigns them to humanity as a whole, but no major issues have arisen from that, as both treaties stimulate member-states to take measures of protection. The question of whom the protection is yet to lead to any problems.

The World Health Organization (WHO) produced the *Beijing declaration*[217], which does not focus on biological knowledge, but on traditional medicine. This is a 1 page, non-binding document, calling upon the WHO member-states to regulate traditional medicine in their countries to ensure promotion, preservation and safe use.

There is one other discussion being held in an international context that could be seen as tangent to the TK discussion. There is the anti-counterfeit discussion which - among others - is being held within the WTO council on TRIPs[218]. Despite the fact that such a discussion could involve the false marketing of non-authentic objects from specific indigenous production, the focus seems to explicitly lie on the quality of counterfeit goods, and the effects on health and safety, and implicitly on the economic value that is protected

[215] Adopted in, Rio de Janeiro on 5 June 1992 and entered into force on 29 December 1993. almost all states are members, except Andorra, the Holy See and the United States (which have signed, but not ratified the convention).

[216] Downes (2000).

[217] Beijing Declaration, Adopted by the WHO Congress on traditional medicine, Beijing, China, 8 November 2008.

[218] In June 2012 the submissions from the US IP/C/W/570, focussing on the supply chain of counterfeit goods, and Japan IP/C/W/571, on trends in the seizure of counterfeit goods, were at the base of such discussions.

with IP rules against counterfeiting. Another example of the anti-counterfeit discussion is the *Anti-Counterfeiting Trade Agreement* (ACTA)[219], a treaty between developed countries only, which is highly controversial with the public, and yet to be ratified by any of its signatories. ACTA, just like the ongoing TRIPs discussion, focusses on the enforcement of existing IPRs. Reasons for this focus are twofold: on one side there are the economic stakes of the right holders and on the other side there is the quality of the products, and consumer-protection. Counterfeiting of traditional knowledge above and beyond the protection in existing IPRs is not part of the treaty. This shows, despite its potential, that the discussion on counterfeiting does not have any real overlap with that on TK protection.

Of these international instruments one could say that the CBD has had the most impact on national legislation so far. It has been mentioned as the only international treaty that acknowledges the role of TK as well as the need to guarantee its protection - whether through IPRs or other means (Dutfield 2001). Criticisms on the CBD concern the concepts of 'access and benefit-sharing principles', 'mutually agreed terms', and 'prior informed consent', imposed to keep the international trade in plant genetic resources free of protectionism (see for example Cottier and Panizzon 2004, Bragdon 2003, and Gupta 1999). These policies have been said to be too cumbersome to sustain continued investment by international corporations, and ineffective in developing countries, where the means for such policies were considered lacking.[220]

So summing up one sees there are currently hardly any binding international frameworks regarding TK protection. International instruments are mainly used to put the TK issue on the map, but the CBD is an example of a more advanced specified international framework for TK protection of a specific from of TK, although there still is a lot of criticism on its effectiveness.

4.3.3. Regional negotiations on integral TK protection

Parallel to the aforementioned global undertakings to create protection of TK, there are three regional documents on the protection of TK. One from the Pacific region, one from the Andes region and one from the African region.

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[219] Which was originally signed by Australia, Canada, Japan, Morocco, New Zealand, Singapore, South Korea, and the United States in October 2011, in Tokyo, Japan, and by Mexico, the European Union in 2012.

[220] For information on how the member-states have implemented the CBD provisions, see the national reports on the status of implementation of the Convention, that each member-state is obliged to prepare in accordance with art. 26 of the Convention.

The Regional Framework for the *Protection of TK and Expressions of Culture* is created by the Pacific Community[221]. The Regional Framework created a model law in 2002, which countries are free to implement. The model law is explicitly for national protection only, and has no international aspect in its protection. This model law provides protection to TK in its broadest sense, compared to other regional frameworks. The examples of TK mentioned in the law include examples of folklore, authentic objects, historical objects, and sacred culture[222]. This model law of the Pacific Community is part of the larger *Traditional Knowledge Action Plan*[223]. Another part of the Action Plan is to develop policy regarding the protection of traditional medicine and biological knowledge (Burchill 2010). This part is to be done in collaboration with the pacific regional environmental program. At the moment of this writing, although a framework for the protection of biological knowledge has been created[224], it has not been adopted, and the subject matter of protection seems to be biological knowledge only, medicinal knowledge does not fall under its scope. Several countries have already proposed bills for the protection of TK based on this framework. Proposals have been made for a regional IPR institution transcending national jurisdictions, to increase the effectiveness of the national legislation protecting TK. [225] These plans are yet to materialize in an actual agreement.

The Andean Community[226] has produced *decision 486: Common Intellectual Property Regime*. Decision 486 was made to reconcile the IP rules of TRIPs, and the CBD. It poses various restrictions on the patentability of biological knowledge, and resources (Helfer 2009).

The Organisation of African Union (OAU) had also created a model law[227], mainly focusing on the protection of biological knowledge. However, the OAU was disbanded in

[221] The Pacific Community has 26 members: American Samoa, Cook Islands, Federated States of Micronesia, Fiji, French Polynesia, Guam, Kiribati, Marshall Islands, Nauru, New Caledonia, Niue, Northern Mariana Islands, Palau, Papua New Guinea, Pitcairn Islands, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu, Vanuatu, Wallis and Futuna, Australia, France, New Zealand and the United States of America.

[222] Art 4, Model law for the Protection of Traditional Knowledge and Expressions of Culture, Secretariat of The Pacific Community.

[223] Pacific Islands Forum Countries Traditional Knowledge Implementation Action Plan of 2009.

[224] Regional Framework on Traditional Biological Resources.

[225] Project No. RG-1: Support to IPR in the Pacific Region, Annex B to Pacific AfT Strategy Regional Implementation Plan 2010-14, Draft report, Artuso, F. 17 August 2009.

[226] The Community of Andean Nations consists of Bolivia, Colombia,
Ecuador, Peru and Venezuela

[227] OAU model law, Algeria 2000, Rigths of Communities, Farmers, Breeders and Access to Biological Resources.

2002. The OAU was succeeded by the newly established African Union[228]. The African Union does not seem to have taken over the OAU model law, as it is not mentioned in any of its documents, constituting or other. However, the African Union has only recently been created, and is in its current state, according to Packer and Rukare (2002) a mere empty shell, that is yet to be developed, with its functioning based on protocols that are yet to be drafted. This means that as the organization evolves in a fully functioning organization it might be expected to reach back to the existing African Model Law and use it in it policy regarding the protection of TK.

Of these three regional frameworks the latter two only target biological knowledge, and not any other forms of TK. The framework of the Pacific Community is unique in its subject matter, and would be the most encompassing, if a framework for the protection of biological knowledge and medicinal knowledge materializes. In its scope it is at the moment still limited to non-binding instruments, which can be absorbed in national legislation. Were the proposals for regional instruments to materialize in the future, this would be a large step forward for the effectiveness of the instruments, as it is planned to transcend the national borders within the region. Although the effectiveness of this regional framework still depends heavily on future work, the process is evolving, and is not slowed down as much as the global attempts at the creation of instruments, or the regional work in the Africa. The future experiences and developments in the Pacific region might be seen as an example, or a test case for other regions, seeking to provide protection beyond the limitations of national jurisdictions. The Pacific region has not succeeded in the creation of such an instrument, but seems to be the one region that has gotten closest yet.

4.3.4. Aspects influencing the creation and working of international instruments

In the analyses in this section various aspects are distilled that are mentioned to influence the international process. Within the WIPO auspices the IGC puts a lot of effort into learning from national experiences. The IGC does this to use this knowledge to create better international legislation. In the WIPO but even more so in the WTO negotiations, there are difficulties to reach consensus when there are too many different subjects that are being discussed within the same negotiations. The risk with broadening the scope of negotiations too much is that it can lead the process to end in a standstill. In all

[228] The Constitutive Act of the African Union: adopted in 2000 at the Lome Summit (Togo), entered into force in 2001.

negotiations mentioned it seems to be the standard that the scale of negotiations, so the number of negotiating parties, has a negative effect on the speed of the process. Also the wider the range of preferences of parties, the harder it is to reach consensus. This creates difficulties to find a common goal in the creation of a one-size-fits-all framework. These difficulties can also be seen in the processes of the topic-specific negotiations, relative to the integral negotiations. From the arguments used in the regional negotiations, and in the WTO discussions, cross-border aspects of TK are reasons in favour of an international instrument. The potential for cost reduction through economies of scope and scale, can also have a positive effect on the workings of international negotiations, through synergy, for instance such as described in Chapter 5.

4.4. An international framework of protection - Potential outcomes of negotiations

Any international agreement is a compromise between the individual preferences of the participating member-states. This section discusses the potential outcomes of international negotiations on frameworks of protection for TK. The approach in this section differs from the current negotiations in the WTO and the WIPO in the sense that it looks beyond the option of large scale negotiations between all participating member-states trying to encompass all forms of TK protection. In this section the option is added of splitting up the negotiations into three separate agreements. These three separate agreements are based on grouping together countries with similar preferences regarding TK protection.

To predict the potential outcomes of negotiations on frameworks of protection for TK one therefore needs to take into consideration the preferences of individual countries regarding their ideal forms of protection. The outcome of the negotiations are a compromise of the preferences of the negotiating parties. Assuming the agreement will have to be reached by consensus, the pivotal voter will be the voter with preferences for the lowest level of protection. In this exercise it is therefore instrumental to identify not necessarily the pivotal voter, but the preferences of the pivotal voter.

As learned from the analysis in Chapter 3, there is strong heterogeneity in preferences of states when it comes to TK protection. There are three distinct approaches that countries take in the choices for TK protection. The three approaches found in the existing national legislation are used as proxies for the preferences of these countries. Based on these proxies the potential content is predicted of international agreements that are the result of negotiations between countries with the same preferences.

When finding proxies for the preferences of countries regarding TK protection two types of information could have been used. The first type of information is the statements of negotiating parties on the topics. The second type of information is the actual legislative acts in the countries. As we found in the previous Chapter and in section 4.3 of this Chapter, countries in general do not practice nationally what they preach internationally, when it comes to TK protection. The reasons for this are many: political, communicational, cultural and perceptional. Political reasons include countries that want to use TK stakes as negotiating leverage in other fields of international negotiations. Communicational reasons include varying understanding of concepts, which leads to countries making similar statements, but with contradictory meanings. Cultural reasons include countries that care about their image in the international arena, and want to be perceived as ethically motivated, but also have other motives to take into account. Perceptional reasons are for example countries who have differing ideas of what TK should be protected for and against, and how that forms of protection can be best achieved. As a result the preferences of countries are more dissimilar than one would gather from the statements made in international negotiations. As a comparison, in a country's national legislative processes a lot of these distorting factors are smaller or non-existent, such as the communicational and cultural factors across countries. Although there can still be political leveraging within a national legislative process, the decisions of national legislators can be expected to more closely reflect their preferences in TK protection than the statements made by international negotiators. That is why the national legislation is seen as revealed preferences of national legislators, and chosen as a proxy for those preferences.

Although it is not clear which factors exactly influence the focus of states when it comes to TK legislation, it is assumed that differences in environment, social and economic circumstances, lead to different needs when it comes to TK-protection (Downes 2000). This makes it hard to imagine that there would exist a one-size-fits-all form of TK-protection. An international common framework for TK-protection would not necessarily entail a framework that results in the same regulation in each country. Like in the current TRIPs agreement, an international framework could set minimum standards for TK-protection. With minimum standards individual member-states can offer a higher level of protection of TK, if they prefer to do so. This way individual member-states can try to accommodate their own countries' preferences in their TK-regulation, as long as it follows the minimum standard of the international framework. In this exercise we allow for an

international framework to exist of minimum standards, but do not limit the potential outcomes to that form.

The outcome of a political bargaining process is hard to predict, as reaching a compromise will be a matter of giving and taking in various topics, most likely not only limited to topics in the field of TK, but linked to a broader negotiation spectrum. If we ignore this part of the creation process of the framework for now, one could reason that the pivotal votes in a consensus vote on such a topic will be the member-states with the wish for the minimum standards that create the lowest TK-protection. This simplification only holds if one can arrange the forms of possible TK-protection on a one-dimensional scale from least protective to most protective[229], or in order words, if the preferences could be ordered in an ordinal way[230]. The question one needs to ask is: can the possible forms of TK-protection, either for a generic TK protection approached as one concept, or for the 3 approaches individually, be grouped on an ordinal way? For the answer to be 'yes' there has to be a clear-cut distinction between those forms of protection that are 'low', those forms that are 'intermediary', and those forms that are 'high' levels of protection. One could argue that forms of positive protection are more elaborate than defensive protection because it allows owners of TK to instigate a protection of their TK on their own accord, without having to wait for others infringing upon their TK, and therefore it provides the most means to TK-holders to find protection of their TK. One could also argue, however, that a form of protection that does not require an active role of TK-owners provides a 'higher' level of protection, as it lowers the thresholds for TK-owners to receive such protection. Looking at the protected interests it also seems hard to determine an ordinal order among the interests. Are active commercial interests the first or 'lowest' interest to protect? One could argue so, when one takes IP as a starting point: this would be the basic interest IP seeks to protect. But on the other hand, one could also argue that ethical concerns would be the easiest to protect, as they could (in whole or partly) be protected by adjusting existing rules, for instance in the rules on trademarks, explicitly mentioning that trademarks cannot be awarded when they are culturally offensive. As some restrictions on

[229] This claim is not entirely true, as pivotal voters can also be identified in the case of a multi-dimensional scale of preferences, as long as these dimensions are each ordinally ordered. This aspect is not elaborately discussed here, as the discussion in this section shows that it is not relevant for the situation at hand.

[230] An ordinal ordering is an ordering in which it is clear to everybody what the order of the individual elements is, which element is higher, and which element is lower for instance, but also which element falls in between. An example of an ordinal ordering is 'good', 'better', 'best'. The 'size' of the differences between the values if not relevant, or not even measurable.

the awarding of trademarks often already exist, this would be a relatively non-invasive adjustment of the existing rules. As this discussion shows, it is not always clear what the ordinal ordering of protection is, or whether it even exists. This creates a challenge in finding the pivotal preference and discussing possible outcomes of international agreements on the subject.

It is of importance whether the goal of the negotiations is to reach an agreement on a general framework of TK protection, as is being pursued in the Doha round negotiations, or whether the goal is a more specific framework for the protection of TK fitting in one specific pillar, to get an agreement for the protection of one specific form of TK, as was done with the CBD. In this section I will first discuss the possible outcomes of an international framework to protect all forms of TK integrally, and then I will look at the possibilities of separate agreements for the protection of approach-specific TK.

4.4.1. Outcomes of negotiations on an integral framework to protect all forms of TK

This section discusses the potential outcomes of negotiations in a setting where an integral framework for the protection of all forms of TK is being negotiated. To do so one needs to ask who the pivotal voter would be. Or more exact: what the standpoint would be of the pivotal voter. In a consensus voting over minimum standards, the member-state whose preferences are the lowest standards will be the pivotal voter because any member-state with preferences for higher protection would still be better off with at least some minimum standards, compared to no minimum standards, and is therefore likely to agree to minimum standards below his preferences, as the outside option is not to reach an agreement at all. It has just been argued that there is no clear-cut ordering of TK-protection on a scale from low to high. On the other hand it does not seem far-fetched to state that no protection at all, would be the lowest protection possible.[231]

There are also countries that have the preference not to have an agreement on the matter at all. So depending on whether these countries are considered essential to be parties to the agreement or not, a possible outcome would be that there would be no agreement at all, as is the case in the current WTO and WIPO negotiations. If we, in this academic

[231] Again this is debatable, as for instance, changes to current IP-rules (so that opposition against new patents infringing on TK belonging to the public domain is no longer possible) could even further diminish the protection of TK, and with that provide an even 'lower' form of TK-protection, than no protection at all. Again, as this is not relevant in this discussion, this is left out of this analysis.

exercise, allow for these countries that are against any form of agreement at all to not partake in the agreement then we can still look at the possible negotiations of the countries that are left. The question then becomes, excluding the countries that are against any form of agreement on TK protection, who would be the pivotal voter? It has been mentioned before that the US, for example, are against any form of binding regulations on traditional cultural expressions[232] and Japan is against any binding instrument obligating members to establish IP protection or a sui generis right for traditional cultural expressions[233]. As not to single any state out, it is very likely that these states are not the only ones with such preferences. It is not crucial to identify any other member-states that are against binding regulation on TK-protection, because regardless of how many member-states have this opinion, if one has this opinion this preference will be the pivotal vote, when consensus needs to be reached. From this, one would conclude that the highest possible minimum standards that could be reached by consensus would be non-binding standards. This means that any instrument created would be soft law, and that any member-state can adopt exactly the regulation it wants, to fit its own preferences. This could then be based on the non-binding standards. Such a hypothetical situation mimics a situation without an international framework, but with international guidelines for regulation.[234] This situation would not be similar to a situation where TK-protection is regulated completely on a domestic level, as the international guidelines are a way of information sharing, and can be valuable for member-states that do not have enough resources to spare to develop their own regulation framework.

A next step of this analysis is to look at possible outcomes of a negotiation process between countries that are looking for binding regulation, so excluding the parties that only want non-binding regulation. As gathered from section 4.3.1, countries that brought arguments against an international regime for the protection of TK include Western countries such as Australia, Canada, Japan, New Zealand, Switzerland and the US.[235] Countries strongly supporting an international regime are South American, African and Asian, namely the countries from the African group, Bolivia, China, Ecuador Peru, Brazil, India, Indonesia, and Pakistan.[236] Although one cannot distil the position of each country from these regions based on the submissions in which the countries mentioned state their

[232] WIPO/grTKF/IC/12/4(b). p. 173.
[233] WIPO/grTKF/IC/12/4(b). p. 173.
[234] Such as the IGC's draft provisions.
[235] See footnotes 209, 210, and 211.
[236] See footnote 206 and 207.

views, this shows a tendency for a regional link between a countries preference for an international regime. It would be premature to conclude that any attempt to a binding agreement could only be achieved through regional agreements, and not in global forums such as the WTO, but the evidence does hint in that direction.

The conclusion from this academic exercise is that an international attempt to provide a general framework for the protection of TK could lead to non-binding guidelines at best, and is not very likely to achieve a binding framework any time soon.

A caveat with this analysis is that it looks at the negotiation process of the specific topic of TK-protection only. It treats member-states in their voting behaviour as rational agents, which in reality of course is not always the case. It does not take into account the fact that negotiations are a political process discussing various topics, which also depend on other factors that can influence the weight and direction of a member-state's vote. (Such as concessions that can be negotiated as leverage in exchange for a change of position in another topic). The outcome of this analysis therefore should be seen in that light, and only be used as a general direction of the outcome of such negotiations, but the actual outcomes can vary.

In the next sections the possibilities for international negotiations on approach-specific forms of TK protection are analysed. By looking at some possible extremes of negotiation-outcomes the size of the distances between the preferences of the negotiating countries can be seized up, to predict how close or how far a possible protection framework resulting from negotiations will be removed from the preferences of the individual countries, in expectation.

4.4.2. Potential outcomes of negotiations on approach-specific agreements

The potential for reaching agreements changes radically when the negotiations are held between countries with aligning preferences. In this section the potential agreements are discussed of negotiations that are approach-specific and between those countries with preferences for TK protection within the respective approach.

4.4.2.1. Potential for agreements on protection within the economic empowerment approach.

Within the approach of economic empowerment traditional medicine is protected for the ownership of indigenous communities, to allow the pursuit of active commercial

interests. There are two different forms of traditional medicine: knowledge on traditional medicinal treatments and knowledge on medicinal uses of goods or products. Traditional medicinal treatments, and the people who provide them, can be regulated by the national legislator. The provision of these services is not easily exported across national borders and a legislator can regulate the services provided within its jurisdiction.

The protection of medicinal uses of specific products is not as straightforward as the protection of treatments or services. Knowledge on such uses is easily transportable to other countries, which leads to the possibility of biopiracy. An example of biopiracy that was successfully overturned is the Turmeric case. A US patent[237] for the medicinal use of turmeric to heal wounds, was revoked after the Indian Council for Scientific and Industrial Research proved the existence of prior art, by showing that this use of turmeric was already acknowledged in Indian medical journals and in ancient texts. Even though the turmeric case shows that biopiracy can be successfully countered, it is also exemplary for what amount of work that needs to be done to successfully fight biopiracy in the world. As discussed in Chapter 3, the TRIPs minimum standards state that the existence of prior art should have prevented the awarding of the turmeric patent. Problems arise when patent agencies are not aware of such existing prior art, or when they do not recognize certain forms of prior art, such as knowledge that is not recorded in writing, or when agencies have limited means or incentives to research knowledge on prior art in other countries, as was the case for the US turmeric patent. The possibility to get patents revoked by post-granting opposition by indigenous communities or interest groups is in theory a possibility. In practice, however, it would require an enormous amount of resources to keep track of all the patents being awarded globally, to check them for the use of TK, and to object to the granting of these patents ex post, whether this be done by the holders of the Medicinal Knowledge, or by potential not-for-profit interest groups. It could be argued that countries that are seeking this form of protection could provide these resources to the relevant TK holders. The problem so far with negotiations on this topic have been that the countries that are seeking this protection do not have the resources available to set up such protection, and the countries that do, do not seem to have preferences in that direction. This seems to be one of the reasons for the impasse in the provision of protection of traditional medicine.

One thing to point out is that this discussed protection against biopiracy is a form of defensive commercial interests. However, within the economic empowerment approach,

[237] US patent no. 5401504.

governments seem to pursue active commercial interests. This aligns with the problems that arise with the availability of resources for the prevention of biopiracy. If there is a form of protection that creates economic value for the holder of the TK, this provides the resources needed to ensure the protection albeit ex ante or ex post injunction by third parties. Economic value can be extracted in two ways, either through a patent-like concept, or through a benefit-sharing-construction. The difficulties with patenting medicinal knowledge have been discussed before; if the knowledge is already prior art, it cannot be patented any more. However if the knowledge is contained in a small enough group, e.g. in one indigenous community, the community as a whole could apply for the patent, allowing for the indigenous community to extract economic value from the monopoly created for the duration of the patent. This would, however, still require initiative and input from the indigenous community, and a vision on the economic possibilities of their knowledge, or the creation of institutions to enable indigenous communities and to stimulate such initiative.

Without the creation of patents there are still possibilities for benefit-sharing. Forcing applicants for new patents to disclose the source of the TK they use, and to provide proof of ex ante permission of the owners of the TK. Standard contracts for benefit-sharing can be created to allow the holders of the TK to economically benefit. Such a construction places the initiative with entrepreneurs who see value in the specific TK. This means that this solution is less demanding for the holders of TK, as it allows them a more passive role. There are some limitations relating to the burden of proof and enforcement. Placing the burden of proof of no infringement on the patent applicant can only take the form of a due-diligence requirement, as solid proof of non-existence of a certain knowledge is impossible. When it comes to enforcement only the holders of TK can protest against a patent being awarded infringing on their existing TK. Which leads back to the problems with the current situation and the amount of resources needed to prevent infringement. However, requirements regarding benefit-sharing agreements with TK holders, and due-diligence requirements with respect to locating TK holders, would shift the balance, and lower the amount of resources needed.

None of the above mentioned possibilities for the protection of medicinal knowledge through international cooperation are watertight concepts of effective protection, nor are they very efficient, however they constitute an improvement for TK protection by at least improving both effectiveness and efficiency from a situation of solely domestic frameworks for the provision of such protection.

4.4.2.2. Potential for agreements on protection within the preservative protection approach

Now let's take a closer look at the possibilities that international negotiations create for protection within the approach of preservative protection. Within this approach the ownership rights to folklore are placed with the state. Depending on the interests a country wants to protect, there are roughly two options for such protection. If the preferences of a country are mainly focussed on defensive commercial interests, or preventing others from claiming rights to the folklore, the country can declare all folklore in the public domain. A work does not fall in the public domain simply by declaring it so by the state, however in the absence of an identifiable author, an identifiable original form of the work, nobody can claim copyright on folklore, which automatically places it in the public domain. A country declaring their folklore in the public domain does not have any legal effect, it merely clarifies the existing situation, and by doing so helps preventing illegitimate copyright claims on works of folklore. This effect goes across borders, as in all countries that are members of the WTO, and that are bound by the TRIPs agreement, copyrights do not come into existence for works that are in the public domain, there are no territorial requirements as to where the works became part of the public domain. A country can stimulate this by making its folklore widely available and easily accessible for the public.

Although not exactly the same, similarities can be found with orphan works. orphan works are works for which a copyright would exist, but no author can be identified. For example, the EU is looking into the possibilities and limitations of making orphan works available to the public[238]. Orphan works are treated in various ways. If there were no licence and remuneration involved, the treatment of the orphan works would be as if they are in the public domain. If there were a licensing scheme and remuneration involved the orphan works are treated as if a copyright exists, and the respective government agency acts for the unknown author in giving out licences for use of the work. Canada has put in place such a licensing scheme for parties wishing to use an orphan work, in which payment is not due, unless the author of the work is located within a certain time after the expiration of the licence.[239]

Ethical concerns were found of a lesser importance within the preservative protection approach, however, they were still found to be present. If a country's preferences are to protect ethical concerns, declaring the folklore in the public domain will not suffice. A

[238] Ricolfi et al. (2007) see section 4.
[239] Copyright Act, R.S., art. 77, Copyright Board of Canada. 2005.

country can then opt for copyrights of folklore to be placed with the nation as a whole, such that the state would be the acting owner of the copyrights, or it could prefer copyrights of folklore to be created and placed with the state. In the analysed domestic legislation that protects folklore, active commercial interests were of no major concern, but if a country were to prefer to pursue these interests, placing the copyrights for folklore with the state would achieve that too. Two adjustments have to be made to the standard forms of copyright, to accommodate such copyrights regarding both the ownership and the term of the copyright. The first adjustment is to place the copyright with the state, as a representative of the actual unidentifiable creators of the works, or the nation as a whole (hereafter 'the state'). Placing the copyright with the state, could be allowed under the TRIPs agreement if that could be interpreted as "more protection" than the minimum standards as prescribed by TRIPs[240]. Such a copyright effectively takes a work out of the public domain, and with that limits the rights of the public to freely use the work. As long as the creation of such a copyright does not interfere with the rights of any real creator of such works, it can be seen as an extra right that is being created on top of the minimum standards of TRIPs, and hence as allowable under TRIPs. This can be done in ways similar to the above mentioned licensing schemes for orphan works in Canada, where the Copyright Board gives out licences. Having a government agency give out licences allows for the protection of both ethical concerns and active commercial interests. The former by not licensing offensive use of the work, and the latter by making users pay royalties for the licences to use folkloristic works.

The second adjustment that has to be made, regards the term of a copyright. This comes into play when works of folklore have been in existence for such long times that it is likely that if a copyright had existed, it would already have expired in the present time. This could be done by extending the term of copyrights from 50 years, as the TRIPs minimum standards require, to a longer term. Extending the term of copyrights is allowed under TRIPs, art 1.1 as the agreement is meant to give minimum standards of protection, and more protection is always allowed. There is no explicit limitation to the length of the term, which means that in theory indefinite terms could be used for this purpose.

One problem arises with this construction of placing the copyrights of folklore in the hands of the state: the recognition of such rights in other countries. The TRIPs agreement

[240] Art 1.1 TRIPs.

and the principle of national treatment[241] require states to allow non-nationals the same rights as they allow their nationals. This means that if the terms for copyright on a book in one country are 100 years until after the publication date, then they should also recognize the copyright on books written by foreigners until 100 years after their publication dates. But a country does not have to recognize the copyright on folklore that another states creates for itself, possibly with a very long term after the first creation of the folklore, if that country does not have these terms in their national legislation. Therefore the creation of such copyrights only has to be recognized by other countries if an agreement to that extend is created, either bilaterally or multilaterally.

4.4.2.3. Potential for agreements on protection within the cultural integrity approach

Now let's take a closer look at possible negotiation outcomes within the approach of cultural integrity, for negotiations only between countries interested in regulations within that approach. Remember that the approach for cultural integrity focuses on the protection of sacred culture, historical objects and authentic objects. The interests to be protected are ethical concerns, and both initiative and ownership are placed mainly with indigenous communities. Splitting up the forms of protection per specific form of TK within this approach, let's look at the possible strictest forms of protection for historical objects, and sacred culture as far as it concerns identifiable objects. The strictest form of protection would be concerned with bringing back the historical objects that are not in the custody of the rightful indigenous communities, and with making sure that these indigenous communities get the right to determine the use of these historical objects. This can be achieved by restricting the sale and export of all historical objects that fall under this protection, after a clear description an definition of which objects these are, how to determine which indigenous communities are the rightful owners to these objects, and return of these listed historical objects to these indigenous communities. Examples of such legislation, are the US Native American graves Protection and Repatriation Act[242], obliging all federal agencies and institutions with federal funding, such as museums, to return all funerary objects to their respective native American tribes and UNESCO's Convention on the means of prohibiting and preventing the illicit import, export, and

[241] Art 3.1 TRIPs.
[242] Pub. L. 101-601, 25 U.S.C. 3001 et seq., 104 Stat. 3048.

transfer of ownership of cultural property.[243] Doing this through an international agreement, as in the UNESCO convention also allows for repatriation of objects that have been exported prior to the adoption of the convention. Possible difficulties can arise with identifying and defining the specific objects that fall under this protection.

For the protection of authentic objects two instruments can be considered: trademark laws or marketing laws. False advertising of products as authentic TK products can be limited. For instance the labelling of products as linked to a specific indigenous community can be limited, as is done in the US Indian arts and crafts act of 1990[244], which prohibits misrepresentation in advertising by falsely marketing a product as made by American Indians or Alaskan Natives, and as done in Panama[245] in the Law on the Special Intellectual Property Regime with Respect to the Collective Rights of Indigenous Peoples to the Protection and Defence of their Cultural Identity and Traditional Knowledge, which places the right to govern the use and marketing of specifically listed objects, such as traditional dress and work tools, with the respective indigenous communities. An international agreement can create lists of the type of objects that fall under this protection and the respective right-holding indigenous communities, or lists of specific indigenous communities and the denominations that are protected, such that no object can be falsely marketed as being made by someone from these indigenous communities.

Through trademark law the registration of trademarks that falsely imply an authentic link with indigenous communities can be prevented, as is done in the New Zealand Trademark Act[246], which does not allow the registration of trademarks that are offensive to Maōri. However, this type of instrument is only feasible if there are a limited amount of indigenous communities to concur with regarding the offensiveness of trademarks. An international agreement forcing the registration of trademarks to be pre-approved by a large number of indigenous communities is impractical and infeasible. In that case a limited list with the names of protected indigenous communities, or for which approval by the respective indigenous communities is needed, is more workable.

The protection of sacred culture that is not captured in specific objects is likely to be the most controversial. A very strict form of protection could entail again a listing of all

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[243] Adopted at the thirty-eighth plenary meeting. on 14 November 1970.

[244] P.L. 101-644.

[245] Ley N° 20 del 26 de junio de 2000 sobre el Régimen Especial de Propiedad Intelectual sobre los Derechos Colectivos de los Pueblos Indígenas para la Protección y Defensa de sus Identidad Cultural y de sus Conocimientos Tradicionales, June 26, 2000 (Published in *Gaceta Oficial* (Official Gazette) No. 24,083 of June 27, 2000).

[246] Trade Marks Act 2002 No. 49, art 17.

existing sacred culture, naming the right-holding indigenous communities. Prior to use of the sacred culture the consent of the respective indigenous community would be required. If this framework is recognized by all participating countries then this prevents offensive use of sacred cultures across borders as well as within. However, controversy might arise around the definition of what sacred culture entails, and which type of sacred culture countries and indigenous communities are allowed to claim. What is considered sacred in one country might not be considered sacred in another, as the controversy around the Danish Mohammed cartoons shows. It is not impossible to imagine that sacred culture in one country might even clash with sacred culture in another. Controversy can also arise when several indigenous communities or countries claim the same sacred culture, and have different ideas about what type of use is considered offensive. This possibility is largest with larger and widespread religions. In principle all religious culture is tradition based. That which makes religious culture fall under sacred culture in TK, is the requirement of TK to be regarded to be pertaining to a particular people or its territory. This means that the protection of sacred culture in a TK context is only limited to sacred culture of small, local religions. Offensive use of sacred culture often happens due to a lack of understanding of the offensiveness of the use, or due to a lack of understanding regarding the sacred value that is attached to the TK in its culture. Sadly however, the offensive use sometimes happens due to a lack of interest in whether or not the use is offensive.[247] The first two reasons can be dealt with by listing all sacred culture, and the respective Communities that can advise over possible offensiveness of intended use, prior to the actual use. The latter can be dealt with by putting regulation in place that obliges users of sacred culture to seek consent from the respective communities prior to the use. The difficulties with that are that a definition of sacred culture that is not very strict, or processes for placing specific forms of sacred culture under this protection that are not restricted enough, would leave room for countries to take advantage of this protection for reasons it was not intended for. The banning of offensive use of sacred culture could be used to ban the use of certain objects, images or rituals for political or other reasons, as opposed to the prevention of offensiveness. It means that indigenous communities in one country could determine about which use in another country is considered offensive,

[247] A combination of these three reasons was found in a TV advertisement by Fiat for one of its new cars. In the advertisement a group of women were doing a Haka, a traditional dance of the Maōri. Before the airing of this add various attempts were made by New Zealand diplomats to persuade the company not to air the advertisement, and to explain why it was offensive, and to help make the advertisement less offensive. Fiat decided to air the advertisement regardless. See for example Frankel (2011).

possibly infringing on basic human rights like free speech. Differences and misunderstandings between cultures can result in countries reluctant to give such power to communities and cultures whose reasoning they find hard to predict and to understand. It is imaginable that very few countries would be inclined to enter into such an agreement. A second difficulty is that countries that do not have sacred culture in their jurisdiction have no incentive to participate in such an agreement, but it is the use of sacred culture in foreign countries that can be most offensive, due to a lack of understanding of foreign cultures. All in all the difficulty would be in agreeing on a hard law to recognize the list of sacred culture of other countries, especially if those list could be adjusted without consensus of all parties to the agreement. Therefore, in the case of sacred culture, soft law aimed at sharing knowledge about the sacredness of certain sacred culture and the possible offensiveness of certain uses would be the highest possible protection achievable through international cooperation

So all in all, the most difficulties are to be expected for the protection of sacred culture, as the preferences of what sacred culture is and what should fall under the protection vary per culture, possible so much that no binding agreement would be feasible. However soft law and information regarding the specifics of sacred culture would already be a large improvement as it could decrease the misunderstandings that underlie some of the offensive use.

4.5. Aspects influencing the efficiency and effectiveness of international agreements

There are various aspects influencing the effectiveness and efficiency of the creation and workings of a framework of protection. If such a framework is set up internationally, these aspects work differently from a setting in which each country sets up its own framework of protection. This section analyses where the opportunities lie for international negotiations, regarding the effectiveness and efficiency of such a framework. To do so a comparison is made between a hypothetical situation in which there is an international framework that sets out to provide protection for TK on the one hand, and a benchmark situation in which no such international undertaking is being made, and protection is completely left to the national legislators on the other hand. This way a clearer picture is painted of both the potential for international negotiations on this topic, and the challenges that will be faced in the creation process.

To identify these aspects an excursion is made to the literature on centralization and decentralization. The (de)centralization issue has long been the issue in the economic theory of federalism (Stigler 1957), the theory of regulatory competition (Tiebout 1956), the theory of the firm (Coase 1937) and theories of hierarchy (Sah and Stiglitz 1986).

Each of these strands of literature discuss pros and cons of central and decentral decisionmaking. A first aspect is that under heterogeneous preferences decentralization of regulation making allows for proximity of policy to local preferences. (Tiebout 1956, Oates 1972). In this report this is translated into the lack of a one-size-fits all form of regulation.

Decentralization of regulatory decisions can create a 'laboratory for democracy', which was first mentioned in 1932 in New State Ice company v. Liebman (285 US 262 (1932),311), meaning that when the effects of regulation are not completely clear yet, having various jurisdiction implementing different regulations will allow jurisdictions to learn from eachother's experiences. In line with this theory is the concept of risk diversification through decentralization (Arcuri and Dari Mattiaci 2010), explaining that under uncertainty on the right decision, the impact of a wrong decision is contained to a small jurisdiction under centralization, and hence this can be used as a risk diversification strategy. I have incorporated these theories in the aspect I call the learning effect.

Another aspect widely mentioned is externalities, or cross-border effects outside of the territorial jurisdiction, leading to suboptimal regulatory outcomes. Externalities do not necessarily have to lead to an inefficient outcome. Coase (1960) stated in his nobel prize winning theorem, that under well-defined property rights and zero transaction costs, the outcome will be efficient. However, in the situation of TK, as in the rest of the real world, transaction costs are not zero. Nor are property rights on TK clearly defined. Hence the market does not necessarily deal with externalities, leading to a suboptimal allocation. Regulation regarding property rights and/or transaction costs could improved the efficiency of this outcome.

Transaction costs could be lowered by making use of economies of scope. This is described by Panzar and Willig (1975) who describe that in the firm economies of scope exist where it is less costly to combine two or more product lines in one firm than to produce them separate.

Economies of scale (Smith 1776) lead to a lower cost per unit when the output numbers increase, or in a decision making setting, lead to more accurate decisions under uncertainty when the number of decisionmakers increases (Arcuri and Dari Mattiacci 2010).

The last aspect discussed is the feasibility of an agreement being formed. Under various names – diseconomies of scale and scope – the difficulties that arise when firms get to big, or the number of products get to diverse are discussed. In a negotiating setting this is translated as to the difficulties of reaching agreement when on the one hand the number of negotiators and the range of their preferences increase, and on the other hand when the number of topics that are being decided upon increase.

In the next sections the following aspects will be discussed (i) economies of scale: the efficiency gains that can be created through international cooperation in the creation of regulation; (ii) the lack of a one-size-fits-all solution to each countries desires for a framework of protection; (iii) the cross-border aspect of both TK sources and products limiting the effectiveness of regulation that is bound to the territorial jurisdiction of a country; (iv) the learning effect, which means that when countries each go through their individual processes of setting up a framework, resulting in a range of countries having a variety of regulations in place, one can learn from the experiences of other countries, to better understand the working of these regulations; (v) economies of scope: the lowering of transaction costs; and (vi) diseconomies of scale and scope; or the feasibility of the international negotiations leading to an agreement.

This section builds on the previous discussion of the possible outcomes of international agreements in section 4.4. The discussion takes place in two parts, first allowing for a situation with one agreement on an integral form of TK protection, but secondly allowing for a situation with approach-specific agreements.

4.5.1. Economies of scale

As discussed before in micro economic theory economies of scale are the cost advantages for firms when production output increase, leading to lower per unit costs of output. This can be because the fixed costs are shared over more units, such as marketing or technology cists, capital and operating costs, and the size of the operating crew, or savings through purchasing in bulk. This concept dates back to Adam Smith (1776), and his concept of division of labour, and the efficiency stemming from learning by doing. Similarly as is discussed more elaborately in Chapter 5,under uncertainty increasing the number of decision makers in a committee leads to more accurate decisions.

One advantage an international framework has over a national one, is that a format for regulation would only need to be drawn up once, and could then be implemented in the domestic legislation of all the countries that are a part of the international cooperation. The

resources that go into the creation of a format for regulation would only have to be used once in an international setting, as opposed to each legislator having to go through the whole process on their own in each country. The combining of expertise could have synergetic effects on the outcome of the work, for example as discussed in Chapter 5. This leads to the possibility of an efficiency gain in the regulatory process trough international cooperation, when compared to national frameworks.

An internationally created framework still requires national implementation. The larger the part of the regulatory process that can be done on an international level, the larger the potential efficiency gain through in international framework. So to determine the potential efficiency gain from an international framework, one needs to determine the relative amount of regulatory work that will be done on an international level, compared to the regulatory work required on the national level.

A chronological simplification of the legislation process starts with the negotiations on a framework of protection on an international forum. This process consists of the decisions on the goal of protection, the interests and forms of TK that need to be protected, how the protection will be provided, up to the drafting of an agreement, possibly consisting of a legislative format or general minimum standards, down to the creation of institutions, whether international or national, and the actual implementation of the protection through the creation of legislation and application of the rules. As no two processes of the forming of international agreements, or regulatory outcomes are the same, there is no rule for where the boundary lies between the part of the rulemaking and rule implementation phases which is done by the negotiating parties and the part which is done by domestic institutions.

To determine the size of the efficiency gain possible through international cooperation, one would have to determine how specific the international framework would be. If the framework consists of various guidelines for various specific forms of TK, than the possible efficiency gain has to be determined per specific form of TK. If however the only agreement possible is one that is very general and broad, to encompass all forms of TK in one agreement, this means that a larger share of the implementation and the regulating of the protection would be placed with the national legislator. Possible efficiency gains through international cooperation would then be relatively small.

In this section the predicted outcomes of international negotiations from the previous section, are used to determine the relative amounts of the regulatory work done internationally compared to the amounts required nationally, to determine how large the

potential efficiency gain through economies of scale is for an international framework. This is done first for a hypothetical integral framework for TK, and then for the three approach-specific frameworks. At the end of this section, Figure 12 gives and overview of the conclusions from this section.

4.5.1.1. Economies of scale in an integral framework for TK protection

Recall from section 4.4.1 that the outcome of international negotiations on an integral protection for TK, can be expected to be non-binding, soft law at best. Globally binding frameworks are not feasible with the current diplomatic preferences on the topic. This means that the current situation at the WIPO negotiations is predicted to be as good as it gets for Generic TK protection.

As is shown in section 4.3.1 with the ever-evolving draft articles at the WIPO, it will be impossible to create soft law that suits the preferences of all participating countries, due to the fact that their preferences vary so much. So given the fact that the guidelines from international cooperation can be vague and broad at best to include all the varying preferences of the participating countries, this means that the bulk of the work will be left to the national legislator. Due to the relatively small share of the legislative burden that will be placed with the international regulator, the potential gains through economies of scale are small, when an integral framework of protection is the goal of international cooperation.

4.5.1.2. Economies of scale in a framework of protection following the economic empowerment approach

Recall from section 4.4.2.1 that the potential outcomes from international cooperation on the subject of the protection through the economic empowerment approach would be split two-ways. Traditional medicinal treatments, the services part of medicinal TK, will have to be largely regulated by national legislators. International cooperation in this case could lead to more efficiency through the sharing of experiences regarding the formulations of legislation, and the forming of institutions. However, because the regulation of these professions will entail licensing schemes for practitioners, and certification of qualified people, the institutions that will need to be created are similar to other institutions regulating certain professions, so the national legislator can look for their own experiences there. Because such institutions have to be tailored to the specific type of traditional medicinal treatments a country seeks to regulate, and these institutions have to

be set up by the country itself, most of the regulatory burden will lie with national regulators. The potential for efficiency gain through international cooperation is therefore low in this category.

For the knowledge regarding traditional medicinal uses of products or goods, instruments targeting biopiracy can entail both an institutionalized and organized way to enable post-granting opposition to revoke patents infringing on traditional medicinal knowledge and adjustments to patent application processes to require ex ante benefit-sharing agreements while placing the burden of proof with the applicant to ensure that no infringement was made on any TK. A third option is the creation of a patent-like sui generis right that allows for the patenting of traditional medicinal knowledge by the traditional owners of such knowledge. All three of these instruments would require a large amount of work from the international regulator. Either one large international institutions have to be created or various identical national institutions following a central concept with a goal of biopiracy opposition. Modification to requirements in application processes of patents can be created in an international framework, only to have to be translated and adopted into national legislation. The new creation of a patent-like sui generis right could be done internationally. It would require a lot of work, but once such a sui generis concept is created it can easily be implemented in the existing national IP-legislation. For all three of these instruments a lot of the work can be done internationally, such that not every national regulator would have to create such instruments out of thin air. With the high uncertainty regarding the specific form, due to the relatively unchartedness of these waters, the potential for synergy from the bundling of expertise is large. The potential efficiency gain from international cooperation on the protection of TK on medicinal uses, through economies of scale, is therefore large.

4.5.1.3. Economies of scale in a framework of protection following the preservative protection approach

Recall from section 4.4.2.2 that there is a dichotomic split between the two potential ways to protect TK that falls in the preservative protection approach, based on the preference for either defensive commercial interests or ethical concerns.

The first serves defensive commercial interests, with the clarification of which folklore lies in the public domain, by making it easily publicly available. One advantage is that a country does not need the cooperation of other countries to do this. However, if there were to exist an international accessible database or register for such works in the public

domain, this would increase the efficiency with which countries can achieve their goal of making it widely known which of their folklore is in the public domain. For this type of protection the bulk of the work can be done by the national regulator. Collecting and publishing the folklore has to be done locally. This means that the possible efficiency gain through economies of scale for international cooperation are relatively small.

Recall that for the protection of ethical concerns in the use of folklore, a copyright-like sui generis right can be created, with a licensing scheme overseen by the state. For this form of protection, the bulk of the work lies in the creation of the sui generis right for folklore. This is no minor challenge, but if done successfully such an instrument can be applied in all participating countries in a relatively uniform way. Due to the fact that still a lot of work would need to be done on for the creation of such a right, the potential for synergy, when expertise is bundled, is relatively large. This means that the possible efficiency gains through economies of scale is relatively large for such a form of protection in this approach.

4.5.1.4. Economies of scale in a framework of protection following the cultural integrity approach

Recall from section 4.4.2.3 that the expected outcomes from international negotiations on protection within the cultural integrity approach are split up for each of the TK forms involved: historical objects, authentic objects and sacred culture. For historical objects restrictions on sales combined with mandatory return to the rightful owners are a solution. The form for such a protection can be quite similar across countries, so the bulk of the work for the creation of the instrument can be done internationally. However, a lot of effort will have to be put in by the national regulator as well, as the implementation of such an international instrument would require identification and listing of specific historical objects. This would by no means be a small task for the countries involved. This means that the potential for efficiency gain through economies of scale for historical objects is neither high nor low, but still substantial.

The same goes for authentic objects. For authentic objects regulations for labelling, marketing and trademarks, regarding specifically listed protected labels, goods, objects or names of indigenous communities will suffice. Most work for such a form of protection lies in the listing of the specific denominations, images, and the indigenous communities involved. However the form of regulations is quite similar across countries, and therefore this can be done on an international level to allow the benefits of economies of scale.

For sacred culture the outcome is most likely to be found in soft law and information sharing regarding offensiveness of certain uses of sacred culture. This entails an elaborate form of international cooperation, in the creation of ways of sharing this information and making it widely accessible. The methods used for this information sharing can be created internationally, allowing for economies of scale, both through synergy and the bundling of efforts. The information supply will still have to come from the national implementation phase, where clear descriptions are needed of sacred culture and which uses are considered to be offensive. This too shows a substantial amount of work both on the international level as on the national level, and therefore a substantial, but not high potential for efficiency gains through economies of scale when approached internationally.

Figure 12. Potential for efficiency gains from economies of scale

Substance of agreement protection of:		**Relative spread of the burden of work between international and national regulator**	**Potential for efficiency gains due to economies of scale**
Integral TK		Mostly with national regulator	Low
Econ. Emp.	Medicinal TK services	Mostly with national regulator	Low
	Medicinal TK uses	Mostly with international regulator	High
Pres. Prot.	Defensive com. Interests	All with national regulator	None
	Ethical concerns and active com. Interest	Mostly with international regulator	High
Cult. Int.	Sacred culture	Substantial for both regulators	Medium
	Historical objects	Substantial for both regulators	Medium
	Authentic objects	Substantial for both regulators	Medium

4.5.2. Challenges for a one-size-fits-all framework

Not all countries have the exact same preferences regarding their regulations. Drawing up one framework of protection and implementing that in all the countries involved, would mean that the format is a compromise. A compromise trying to fit all the preferences of the participating countries, creates a perfect fit for none of the countries. In expectation such an international framework does not result in as good a fit as a purely domestic framework. This means that an international framework will lead to an effectiveness loss compared to a national framework.

When preferences vary across regions, it will be harder to find one form of regulation that fits with all these preferences. Sykes (2000) points out that there are several types of regulatory cooperation, which each involve varying degrees of intrusion into the autonomy of regulators. In other words flexibility in implementation, for instance from agreements on minimum standards or with non-homogeneous regulatory targets, can counter the lack of a one-size fits all framework. Tödtling and Trippl (2005) apply this concept to regions with differentiated regulation for innovation policies, when they point out that "no best practice exists when it comes to policy: no one approach can be applied to all regions. Policy chould be differentiated dealing with specific needs and barriers".

If the agreement, resulting from the international negotiations, allows for some flexibility in the implementation of the protection, for instance in the case of minimum standards, this decreases this loss of effectiveness. How much flexibility a country is allowed in the implementation of the regulation, and how close such flexibility can bring a country to their optimal point of preference, depends on various factors, such as strictness of the international agreement, dependency of implementation of the protection in other countries, etcetera.

The lower the minimum standards, the less a country can rely on other countries to hold up high standards of protection in their own jurisdictions. A decrease in the loss of effectiveness due to the flexibility in standards, therefore decreases the efficiency gain regarding the cross-border aspect, which will be discussed in section 4.5.3.

In this section the expected distance and spread between preferences and outcomes of implemented frameworks is analysed to predict the effectiveness loss due to the fact that no international one-size-fits-all framework can be created. At the end of this section, Figure 13 gives an overview of the conclusions.

4.5.2.1. Challenges for a one-size-fits-all integral framework of TK protection

Recall from section 4.4.1 that an international framework for an integral protection of TK leads to soft law with non-binding standards. This gives countries a lot of flexibility in the implementation of such standards, but how close they would be able to get to their individual ideal point of protection depends mainly on how much they rely on other countries in achieving the level of protection they want. For example the more misappropriation of TK happens in other countries than the country of origin, the more a country relies on other countries in achieving its preferred level of protection. Note that

this dependency on other countries relates to the size of the cross-border aspects of the specific TK a country wants to protect. This means in turn that the possibilities a country has in reaching their ideal level of protection through the flexibility of the implementation phase differs per country. This means that for some countries their preferred level of protection is relatively achievable, and their effectiveness loss through international cooperation relatively small. These countries would mainly be the countries with a preference for a low level of protection, or a low preference for the protection of TK that is sensitive to cross-border aspects. On the other hand, countries with a preference for a high level of protection and a large dependency on other countries' implementation of TK protection for their preferences of protection of cross-border sensitive TK, will not profit much from the possibilities an international framework would offer, and they will not be able to achieve a level of protection close to their preference. Note that these cross-border aspects will also not be offset in a national framework. Both a national framework and an international framework would be rather ineffective in this sense, so the effectiveness loss purely stemming from the fact that the framework is set up internationally is relatively low.

4.5.2.2. Challenges for a one-size-fits-all framework following the economic empowerment approach

Countries seeking to regulate traditional medicinal services have substantial flexibility when setting up national institutions, and as the provision of such services is not influenced by the regulations in other countries, countries can reach a level of protection closely to their preferred level. The effectiveness loss through international cooperation would therefore be small.

For the regulation of an international instrument tackling biopiracy ex post the preferences of the countries that would be likely to create such an instrument are rather similar. There is not much divergence amongst these countries about what entails biopiracy, and if they bundle their forces in an organized way of fighting biopiracy ex post, not much compromise is be needed on the goals of such an instrument, compared to a situation in which such an instrument is be created nationally. The effectiveness of such an instrument mainly depends on the legislation on patents in the country in which the patent was awarded. This is not affected by whether the instrument of ex post protection were to be construed on an international or on a national level. The effectiveness loss due to differences in preferences would therefore be small if such an instrument were to be created. However, if the TK regarding medicinal uses is to be protected ex ante, by the

creation of a patent-like sui generis right, there is a potential effectiveness loss due to the lack of a one-size fits all solution. The requirements for such a sui generis right need to be discussed by the participating countries. Due to the differing situations between these countries, they are likely to have varying ideas about which types of uses to protect. These preferences can be opportunistic, for instance a country where the knowledge is regionally localized might prefer a restriction in the sui generis right that is linked to territory, like in geographical indications, however a country where the knowledge is more ethnicity bound, and not linked to any specific geographical areas might have different preferences. This means that for an ex ante instrument for the protection of TK on medicinal uses compromises would need to be made regarding the individual preferences of countries, leading to a substantial effectiveness loss in an international framework due to the fact that not all preferences will be able to fit in one framework.

4.5.2.3. Challenges for a one-size-fits-all framework following the preservative protection approach

The analysis in section 4.4.2.2 showed a clear-cut dichotomy in preferences within the approach of preservative protection. As described before, countries with preferences for defensive commercial interests, can improve information about the fact that their folklore is in the public domain, by listing this folklore and making these lists easily accessible also to other countries, to prevent wrong assumptions over copyright on works using folklore. The preferences of countries that have a goal of defensive commercial interests do not vary much between them, and as they do not rely on the regulatory actions of other countries they can reach their preferences quite accurately.

Countries that have preferences for ethical concerns will have more difficulties reaching their exact preferred levels of preferences. Just as in the situation of ex ante protection for medicinal TK, a sui generis right needs to be created. The different preferences on the specifics will lead to an effectiveness loss due to the compromises that would have to be made on the exact concept of the sui generic right, when done on an international level, compared to a sui generis right created for an by one country only.

4.5.2.4. Challenges for a one-size-fits-all framework following the cultural integrity approach

For sacred culture the outcome is expected to be in the form of soft law. This gives countries the same flexibility in legislative choices as they have when no international soft

law exists. The loss of effectiveness due to compromises on the international level is therefore nil for sacred culture. Both for historical objects and for authentic objects, however, the international framework has to describe what type of objects or characteristics of objects are allowed to fall under the newly created protection framework. As the preferred characteristics vary between countries, compromises have to be made. This will lead to some loss in effectiveness of the regulation, compared to a situation in which such compromises do not have to be made.

Figure 13. Expected loss of effectiveness from the lack of a one-size-fits-all framework in an international framework of protection.

Substance of agreement protection of:		**Loss of effectiveness due to compromising on preferences and flexibility in implementation**	
Integral TK		High flexibility with soft law	Low
Econ. Emp.	Medicinal TK services	High flexibility in implementation	Low
	Medicinal TK uses	Compromise on content of ex-ante, not on ex-post.	Medium
Pres. Prot.	Defensive com. interests	Same as when done nationally	None
	Ethical concerns and active com. interest	Compromise on content of sui generis	High
Cult. Int.	Sacred culture	High flexibility with soft law	None
	Historical objects	Compromise on definitions	High
	Authentic objects	Compromise on definitions	High

4.5.3. Cross-border aspects

Demsetz (1967) described externalities as follows: "The concept includes external costs, external benefits (…) What converts a harmful or beneficial effect into an externality is that the cost of bringing the effect to bear on the decisison of one or more of the interacting persons is too high to make it worthwhile. 'internalizing' such effects refers to a process, usually a change in property rights, that enables these effects to bear (in greater degree) on all interacting persons. A primary function of property rights is that of guiding incentives to achieve a greater internalization of externalities". Trachtman (2000) applies this concept to regulatory competition discussing that efficient laws in one jurisdiction can impose costs in other jurisdictions. Coase pointed out that the market will internalize these externalities under zero transaction costs and clearly defined property rights. As pointed

out earlier neither of these conditions exist in the TK world. Dahlman (1979) suggests that either a market structure change (for instance through property definition) or central intervention, for instance by lowering transaction costs, can improve total welfare.

The application of legislation of a country is limited to the territorial jurisdiction of that country. However that does not mean that all effects of such legislation are limited to the territory of that specific country, adopted legislation can have intended or unintended effects outside the borders of the legislating country. On top of that the possibility exists that this territorial limitation of legislation means that the effects do not reach far enough to achieve all the intended effects. TK is not necessarily subject to the same spatial limitation as the territorial jurisdiction of the legislation aiming to protect it. I would like to call this the cross-border aspect. To determine whether TK-protection can be provided efficiently and effectively, it is important to determine to what extend the various options of TK-protection that were discussed before can provide the protection that is intended, given the potential for negative externalities due to the cross-border aspect.

These cross-border aspects can create negative externalities when the national legislator has no incentive to take into account the effects the legislation has outside his jurisdiction. It can result in legislators deciding to protect certain TK within their jurisdiction leading to negative externalities for individuals outside of their jurisdiction, for example by allowing foreign TK to be patented by parties other than the rightful owners.

The cross-border aspect negatively influences the effectiveness of national legal instruments. An international framework of protection has an advantage over a national framework as it can counter the negative effects of the cross-border aspects. The size of this relative advantage is determined by specific characteristics like the relative mobility of the TK products, the mobility of the TK knowledge and the spread of sources of TK across borders.

Some TK can be claimed by more than one indigenous culture, residing in various countries (neighbouring or not). Country borders do not always coincide with the spread of the population. This can lead to a situation where an indigenous people, has a living area stretched across national borders. Either of these two situations can lead to difficulties that have to be considered, when it comes to TK protection.

The first situation, of TK owned by multiple indigenous peoples, spread over more than one country can cause problems, when one group receives IP protection of their TK in their home country. This means that the other (foreign) group can no longer benefit from the use of their shared TK in that country. This creates a negative externality of the

domestic IP protection for the foreign indigenous people. Such negative externalities can be resolved within the regulation regarding TK protection for instance through co ownership of both indigenous peoples, but domestic legislation can favour nationals, as there is no incentive for national governments to protect foreign indigenous peoples' rights, at the cost of domestic indigenous peoples' rights. This can be resolved through international cooperation. Bilateral or multilateral agreements can make countries agree to award foreign indigenous peoples similar rights to their domestic indigenous peoples, when it comes to the protection of TK. In this regard, an international framework is able to resolve some of the issues that national legislation alone cannot. Bilateral reciprocal agreements between the countries in which the indigenous peoples live, who share their TK, can resolve the issue, but so can regional or international agreements on a global scale. A global approach for this specific problem however, uses an unnecessarily big scale instrument to solve the problem, as it is most efficient to only negotiate amongst the countries involved.

The second situation, of one indigenous people, whose territorial connection stretches across national borders, does not create any negative externalities. The indigenous people have to apply for IP-protection of their TK in both countries separately, under either approach (national or international). No third parties are affected by this. A small advantage of the international approach is that similar regulations between the two countries can make the application in the two countries very similar, which could lower the transaction costs of the applications. This latter point however, falls under the aspect of economies of scope.

As for neither of these situations there is a significant difference in efficiency between a domestically regulated protection of TK and an internationally regulated protection of TK, there is no need to split this part of the analysis up for each of the three approaches.

Tangible objects that are the product of TK can be moved across national borders. Traditional medicine can be commercially exploited in various countries, and pieces of art can be transported and sold across the globe. This creates an extra hurdle for the protection of such mobile TK products. When indigenous communities have their TK protected in their own country, this does not necessarily mean their TK is protected in other countries. This TK can still be exploited (and maybe even patented) by third parties in other countries. It can be very hard for patent granting offices to figure out whether such knowledge already existed as TK, and whether it belongs to someone else (an indigenous

community in this example), or whether it already is part of the public domain[248]. In the first case the indigenous peoples that are holder of TK have to incur vast costs to make sure worldwide no patents are granted that infringe upon their TK rights, by opposing to any application to an IP that would do so. In the second case, it is the public that incurs the costs, when individuals use knowledge from the public domain and patent that in a foreign country. The public in that foreign country then incurs the costs of not being able to freely use the knowledge that belongs to the public domain. This latter situation should not exist with correctly applied IP rules (see footnote 162), but in reality, due to limited abilities of patenting offices, does occur. These two problems are not any different whether national systems differ, with national frameworks of protection, or are more similar, within an international framework of protection. No efficiency gains or losses occur in either level of framework. However a possible solution to the first problem can be found in an international database in which TK is registered. However, the effectiveness of such a database has been questioned (Dutfield 2003) due to the differences between national laws regarding the way information in the public domain should be described in order to constitute novelty-defeating prior art, and due to possibility of enabling TK-piracy through publication of such databases.

A solution to the problem of TK in the public domain of another country can only be found in more resources to support better research regarding whether or not the information is part of the public domain. The required investment of resources by national legislators, however, would only benefit parties outside the country's jurisdiction. This creates a mismatch of incentives. Whether or not the funds are available, it is also a matter of willingness to invest for the benefit of others. It is doubtful whether sheer willingness to invest resources would change when the protection is approached through either a national or an international framework, although one can imagine the possibility of a transfer of wealth from the wealthier nations to the less wealthy nations in this respect.

At first sight it seems that this challenge is no different in a national framework than it is in an international framework, however the possible (partial) solutions are best achieved through an international instruments. The size of this advantage of an international framework over a national framework depends on the mobility of the TK products. The sizes of the effects differ per approach, due to varying levels of mobility. These effects will be discussed per approach first, and then for an integral approach to TK protection.

[248] As was the case in the aforementioned example of the healing powers of Turmeric powder, which were patented in the US, but which were part of the public domain in India (see section 4.4.2.1).

4.5.3.1. Cross-border aspects in the economic empowerment approach

The approach of economic empowerment can be broken down into two types of TK: medicinal treatments and knowledge regarding medicinal use of products. As traditional medicinal treatments are relatively immobile, as it requires training an individual knowledge transfers between individuals that are relatively high in costs and effort, the positive effect of an international approach is small. An international framework is therefore expected to have no effect on the effectiveness of legislation.

The products or knowledge of the uses of traditional medicine are relatively mobile. Uses of plants, for example, can be patented all around the world, as the aforementioned Turmeric case shows. Also, such patents have a potentially high value if exported. Due to the high mobility of this form of TK an international framework can improve the effectiveness substantially, compared to a national framework.

4.5.3.2. Cross-border aspects in the preservative protection approach

Mobility of folklore can be high, as music, stories and plays can easily be transferred and used across borders. However the market for such TK is relatively small, resulting in a rather low factual mobility of folklore. If a state decides to clarify that folklore is in the public domain and makes it widely available, this affects the potential for piracy all around the world, as the public domain is not territorially limited. A state is more likely to have the means to make it known that this knowledge belongs to the public domain, then indigenous communities or individuals. And in doing so it lowers the possibilities for other parties across the border to misappropriate the folklore.

However, if a state claims property of folklore through a sui generis right created in an international framework, and such a sui generis right is mutually acknowledged between the participating countries, this increases the effectiveness of the sui generis right compared to a situation that a national legislator were to create such a right domestically. The size of the effectiveness improvement depends on the number of states that participate in the framework, and acknowledge the sui generis right within their territory. The potential for effectiveness gain is relatively large however in absolute terms tempered by the low actual level of mobility of folklore.

4.5.3.3. Cross-border aspects in the cultural integrity approach

Within the cultural integrity approach, tangible objects are highly mobile and can easily be moved outside the jurisdiction of a country. An international framework for the

protection of these products is more effective, because it allows for an agreement on the retrieval of historical objects by the indigenous communities that hold the ownership, or on the prevention of authentic objects that are falsely marketed as genuine traditional objects from a specific indigenous community across the borders of the country to which that indigenous community belongs. Sacred culture on the other hand is often not tangible, but the offensive use is not restricted to a geographical area, and can therefore be very vulnerable to ethical concerns in its cross-border use. So, in one way or another, each of these forms is highly mobile, and therefore the potential gain in effectiveness due to the cross-border aspect is large.

4.5.3.4. Cross-border aspects in an integral approach to TK protection

In an integral framework of TK protection the influence of the cross-border aspect is a weighted mix of the influence on individual forms of TK. This is due to the fact that the extent to which an international framework can address the cross-border issues is not negatively affected by a broadening of the scope regarding the subject matter that is protected. Adding more forms of TK under the subject matter on which that instrument is applied, does not affect the territorial jurisdiction in which the instrument is applied. It is hard to determine a weighing factor, as it can be based on a number of factors, such as the amount of products, the sizes of the cross-border flows of TK, the monetary value et cetera. No numbers are available on any of these factors, however, taking into account that the effects are predicted to range from low to high, one can assume the size of the effect to be somewhere in the middle.

Figure 14. Advantage of an international framework in effectiveness to counter the negative effects of cross-border aspects.

Cross-border aspect		**Benefit of an international framework for the effectiveness of protection of TK**	
Econ. Emp.	Products	High mobility	High
	Services	Relatively immobile	Low
Pres. Prot.	Defensive com. Interests	Relatively immobile	Low
	Ethical concerns and active com. Interests	Mutual recognition, but relatively immobile	Medium
Cult. Int.	Sacred culture	Offensive use not location bound	High
	Historical and authentic objects	Highly mobile	High
Integral TK		Varying levels of mobility	Medium

4.5.4. Learning effect

In the literature on federalism the experimental effect is mentioned as an advantage for effective law-making in a situation where there is still uncertainty about what the optimal form of regulation would be[249]. As discussed in the beginning of this section This was first suggested in New State Ice Company v. Liebman (285 US262 91932), 311, and has been elaborated on by Sykes (2000) and Arcuri and Dari Mattiacci (2010) The experimental effect is the advantage that can occur for regulators from the information that is gained when various regulators set different rules. The experimental effect works as follows in federalism: some, or all individual states within a federal state can adopt their own regulation on a specific topic, and then the federal union of states can be seen as a laboratory to find out what the effects are of the various regulations adopted. The benefit of this experimental effect is that eventually all states can adopt the regulation that is most effective, learning from the experiences of all other states and their respective regulations. The costs that are incurred by the states that first adopt one regulation, and then later decide to change to another regulation, are low enough in situation of high uncertainty about the effects of the available regulations. The reason for this is that if states are not able to take this experimental approach, they have to base their choice of regulation on less information, which in expectation results either in less effective regulation, or the need for (several) changes of regulation, which would be more costly then the experimental effect. Another benefit of the experimental effect is that it can be easier for the population to embrace a regulation that is based on past experiences of other states, than a regulation that has not been used before.

The situation discussed in this Chapter, regarding the creation of an international framework, is not the same as the situation of the experimental effect in federal states. However, the similarities in the potential learning curve for new types of regulation are eminent. Therefore in this section the learning effect is introduced, stating that a lot can be learned when states share their experiences with relatively new instruments in regulatory areas.

As shown in the analysis of Chapter 3, the countries that have already provided some form of TK-protection in their domestic legislation, have done so in different ways, but there are also many similarities between states with a similar focus when it comes to TK

[249] See Strumpf (1999) for a discussion on this concept, and Sachs (2007) for an example of an application of this concept.

protection. Legislators of countries that have not yet adopted domestic legislation on TK-protection, or that deem their current domestic legislation insufficient, can learn from the experiences that other countries have had with the specific form of TK-protection these countries have adopted, especially if they focus on countries that have similar preferences to their own. Much can be learned about specific forms in which TK-protection is provided, but also for fine-tuning of the scope of such forms domestic experiences of other countries can be helpful.

When countries are allowed to develop legislation themselves, without an international framework, the diversity of forms of protection and instruments, allows for the learning effect to improve the quality and with that the effectiveness of future legislation. The more unknown a form of protection is and the more uncertainty surrounds the de facto working of an instrument, the larger the learning effect and the larger the potential effectiveness gain from the forming of national frameworks, in the absence of an overarching international framework.

Enabling such a worldwide laboratory environment in the case of TK-protection, can be expected to yield more effective regulation in the medium run, than an international adopted common framework that would only arise in the long run. This way countries with less means have the opportunity to not adopt any regulation yet, wait until the results of the regulations adopted by other countries have become clearer, and then adopt a regulation of their own. Countries that feel the need to adopt a regulation without delay can do so as well.

It has been mentioned that such an approach can end up in a waiting game, a situation in which no country adopts any legislation, because they all strive to use the experiences gained by other countries to the greatest amount possible, to minimize their own costs. Such a waiting game would result in a vicious cycle in which no countries adopt any legislation before the others. But no empirical evidence has been found to prove that such a situation occurs. Moreover, the fact that there already are numerous domestic regulations on TK-protection contradicts the concept of a waiting game.

Information sharing, for instance in WIPO reports of countries, can be very valuable and can maximize the benefits of the learning effect of domestically adopted legislations. The same goes for overviews of existing legislation as given in Chapter 3.

In this section an overview is given of the extent to which an international framework would hinder such a learning effect, compared to a situation of nationally developed frameworks.

4.5.4.1. The loss of the learning effect in an integral TK approach

As discussed before, an agreement for a generic form of TK will most likely not contain any ground-breaking new forms of protection. However, it is also highly unlikely that it would inhibit the national development of new forms of protection, due to the expected flexibility in such an agreement. The expected loss of effectiveness through an international framework, due to inhibition of the learning effect is therefore nil.

4.5.4.2. The loss of the learning effect in an economic empowerment approach

As in the previous sections, the discussion on the effects in the economic empowerment approach is split between medicinal treatments, and knowledge regarding medicinal uses of products. For an agreement on the first, now newly developed instrument is required. The potential forms of protection are already known. The loss of effectiveness through missing out on the learning effect is therefore nil.

For the protection of medicinal uses of products, various forms of protection were discussed. In the case that through an international framework a sui generis right is chosen and implemented, this is likely to slow down the development of other variations of protection. National legislators will not feel the need to experiment with other forms of protection if they are already participating in an international undertaking with a sui generis right. This means that the expected loss of learning effect through the creation and implementation of an international framework is large in this case.

This will be less so for benefit-sharing agreements. No completely new type of legislation will have to be created, but there can still be some unknown specifics of the requirements needed for the framework to be effective, on which various actual experiences could shed some light. For the revoking of patents by a centralized institution, through post granting opposition, the loss of learning effect will be small. The process of post granting opposition is a clear and straightforward process. It has been done in the past. The benefits that can still exist in gaining more experience in post-grant opposition exist whether the opposition is done by a private party, a national institution of by an international institution. The potential loss of a learning effect is therefore small in this regard.

4.5.4.3. The loss of the learning effect in a preservative protection approach

For the approach of preservative protection, aimed at defensive commercial interests, the loss of learning effect in an international undertaking would be small. The concept used is the public domain, which is already well known and not surrounded with much uncertainty on its workings. No new concepts have to be developed, and therefore there is hardly any potential for a learning effect neither in a national, nor in an international framework.

However, for the protection of ethical concerns or active commercial interests a sui generis right has to be developed. No such rights exist yet and therefore a lot of uncertainty exists about the de facto workings of such a sui generis right. The potential benefit of learning from various national experiences is large, but would be missed if the sui generis right were to be created in an international framework.

4.5.4.4. The loss of the learning effect in a cultural integrity approach

The flexibility of an international framework of soft law for the protection of sacred culture would not hinder the development of new forms of legislation in the participating countries. The potential for a learning effect is therefore the same under an international and a national framework.

For the protection of authentic objects existing concepts would be used, such as trademark law and restrictions on labelling and false advertising. The amount of domestic experiences with such legislation is already large. The potential for a learning effect is small, whether the framework of protection is created nationally or internationally. The same goes for the protection of historical objects. No new concepts need to be created, which does not allow for much of a learning effect.

Figure 15. Potential loss of effectiveness in an international framework due to the loss of a learning effect

Learning effect		**Potential loss of effectiveness in an international framework compared to a national framework**	
Integral TK		Still allows for development of new concepts	None
Econ. Emp.	Products	Development of new instrument not required	Low
	Services	Depending on chosen form of protection	Medium
Pres. Prot.	Defensive com. Interests	Development of new instrument not required	None
	Ethical concerns and active com. Interests	Development of sui generis right required	High
Cult. Int.	Sacred culture	Still allows for development of new concepts	None
	Historical and authentic objects	Development of new instrument not required	Low

4.5.5. Economies of scope

Up to now we have looked at efficiency and effectiveness in the regulation and implementation phase, from a regulatory point of view. In this section we are going to look at the phase in which the regulation is implemented and is being applied in practice. More specifically, we are looking at the potential efficiency gains during the application of the implemented regulation, both for the party applying for the protection, and for the institution processing the application. Economies of scope arise when processes can work more efficiently because they are grouped together in one way or another, with other processes, leading to synergy.

The economies of scope in the firm were first described by Panzar and WIllig (1975 and 1981) and elaborated on for example by Bailey and Friedlander (1982) and Helfat and Eisenhardt (2004).

In section 4.3.1.2 some situations were mentioned in which transaction costs affect the efficiency of TK protection. Transaction costs can be lowered through international cooperation. This can happen in two situations, one on the side of the applicant, and the other on the side of the agency processing the application. The first occurs when a party wanting to apply for protection of his TK has to do so with various institutions, for instance in multiple countries. The latter situation happens when the information that is needed in national processes for protection is easier accessible due to the international cooperation. For example if there exists an internationally accessible database of TK in the

public domain, as suggested in the Doha-round negotiations (see footnotes 169-173), this limits the search costs into prior art for the agencies that have to decide whether a patent can be awarded or not. Such lowering of transaction costs means an increased efficiency. In this section it will be determined whether an international framework allows for such efficiency gains through economies of scope, over national frameworks. So only if the application of the regulations costs more resources if the regulation is set up nationally, there is room for economies of scope. In situations where an international framework creates transaction costs different from those in a national framework there are no economies of scope.

4.5.5.1. Economies of scope in an integral TK approach

As a framework of protection for all forms of TK is expected to be non-binding, this means that there is expected to be divergence between countries in the forms of protection provided. Similarities can occur from model laws that are used as templates for domestic legislation. However an integral TK framework is not expected to lead to more similarities in processes of protection, than a situation in which no such international framework exists. The lack of expected similarities between processes across countries leads to the conclusion that the potential for economies of scope is small for an integral TK framework of protection.

4.5.5.2. Economies of scope in the economic empowerment approach

For an international framework within the approach of economic empowerment the possibilities for economies of scope lie mainly in the protection of knowledge regarding medicinal uses, and not so much in the protection for medicinal services. The latter is implemented nationally, and tailored for the relevant forms of medicinal services and treatments. The application procedures for individuals seeking licences to provide these medicinal services can vary widely across countries. Also the individuals seeking such licences is unlikely to do so in many countries, as the provision of medicinal treatments is a mainly local activity. Therefore no room for economies of scope exists that can lower transaction costs for the provision of protection to such medicinal treatments.

However for the provision of protection for the knowledge regarding medicinal uses, opportunities for economies of scope exist. As discussed in section 4.4.2.1, there might be several ways in which TK regarding medicinal uses can be protected. One suggestion is an organization actively searching for patents infringing on TK to get such patents revoked -

however complicated and elaborate such a suggestion might seem. If brought into practice, a combining of the forces and resources internationally to create one such international institution, as opposed to several national ones, will save significantly on transaction costs.

A benefit-sharing obligation, with a burden of proof placed with the applicants of new patents, creates large search costs. A database, with a list of all TK regarding medicinal uses, identifying the rightful owners to those rights, lowers these search costs significantly. Fears of such a database enabling biopiracy are not justified de jure, as the listings themself show proof for the right holders. The obligation of benefit-sharing of anybody using the knowledge should provide the certainties that right holders receive their fair share. However, de facto, the costs to monitor for such biopiracy are high, and without any extra means or an institution specifically for that purpose it is inconceivable that the threat of ex-post billing for biopiracy is sufficient to prevent it from happening.

The third suggested instrument, the patent-like sui generis right, allows for large efficiency gains through the lowering of transaction costs. If the sui generis right is created nationally, processes are likely to vary between countries. Any TK holder seeking that protection then has to file individual applications in each country, following the specific requirements of each national instrument. However, if this sui generis right is created internationally, the requirements are similar in all participating countries. Transaction costs will be lower per application for a TK holder applying for protection in each of the participating countries. One can even imagine a central institution where a TK holder can apply for protection in all the participating countries at once. Needless to say that this would lower the transaction costs even more.

4.5.5.3. Economies of scope in the preservative protection approach

As mentioned before, folklore that is protected for defensive commercial interests, can be placed in the public domain. The potential for efficiency gains through the lowering of transaction costs through in international frameworks, lies in the possibility to have a central point in which such folklore is collected and made available to the public. Such a central point can be a digital database of recordings or descriptions of folklore, for instance similar to the website librivox.com, which contains a collection of audio recordings of published work in the public domain, freely available to the public. The costs of making information publicly available are relatively low compared to the identification and collecting costs. The efficiency gains from a central point for publication would therefore not be very large, but still substantial.

For folklore protected for active commercial interests or ethical concerns through an internationally created copyright-like sui generis right, no repetition of copyright procedures is necessary if mutual recognition between participating countries is put in place. This means that only one application procedure is needed. If the sui generis right is created nationally, this is different, as it is likely that the content of the rights and the requirements will differ. This means that the potential for efficiency gains through the lowering of transaction costs through an international framework are substantial in this case.

4.5.5.4. Economies of scope in the cultural integrity approach

For historical objects, the objects that fall under the protection have to be individually identified. The procedures for protection of historical objects are likely to be per individual object. For historical objects that are within the territorial boundaries of the country where the original right holders are, the procedures for protection will be purely domestic, regardless of whether an international framework exists or not. However for historical objects which need to be returned from across borders, a national framework will not be able to achieve this, and ad hoc diplomacy between the two countries involved needs to be used, with the transaction costs that come with such extensive processes. Even though the example in the introduction of the Toi Moko regarded the return of human remains, not historical objects, the extent of the diplomatic process is similar to what would be needed for historical objects. Were there an international framework in place for this type of cases, clarifying the ways in which an indigenous community can reclaim their historical objects, this can speed up the process and lower the transaction costs. To what extent this leads to efficiency gains depends on how often an indigenous community has to go through such procedures, or in case they are helped by a government agency, how often that agency has to deal with these procedures. Therefore the efficiency gain through economies of scope for historical objects is expected to not be very large, but still substantial.

For authentic objects the reasoning is similar. The most use of such protection will be within the territorial borders of a country, for which no economies of scope will exist through an international framework. However, across borders, a sharing of the lists of protected names, emblems and other denominations can lower the transaction costs, similarly, if the application procedures are similar between countries for indigenous communities to have their TK placed on such protected lists this would lower transaction

costs in these specific situations. This, however, will only be needed for that part of the authentic objects that is to be protected across borders.

For sacred culture a framework for information sharing regarding the offensiveness of certain uses, provides a way for indigenous communities to have their information shared with all participating countries at once. If no international framework existed such information would have to be shared through ad hoc channels. However, most of the work will be in collecting and compiling this information, the sharing of the information does not create large transaction costs. So, as the costs of the transactions are small, the efficiency gains are also small.

Figure 16. Potential for efficiency due to economies of scope

Economies of Scope		**Potential efficiency gain in an international framework compared to a national framework**	
Integral TK		Not much similarity in procedures expected	Low
Econ. Emp.	Products	Transaction costs can be lowered substantially	High
	Services	Not much repetition of procedures expected	Low
Pres. Prot.	Defensive com. interests	Transaction costs can be lowered	Medium
	Ethical concerns and active com. interests	Similar procedures can be implemented in the participating countries	High
Cult. Int.	Sacred culture	Transaction costs not expected to be lowered substantially	Low
	Historical and authentic objects	Some lowering of transaction costs possible	Medium

4.5.6. Diseconomies of scale and scope, or the feasibility of reaching an international agreement

Throughout this Chapter, the focus has been so far on possible outcomes of international negotiations. In this section the focus is on the possibility that negotiations do not lead to an outcome, due to difficulties resulting from either the number of negotiators and the range of their preferences, or due to the number of issues that are being negotiated on within the same agreement.. If there is anything that one can learn from the Doha round negotiations, it is that the possibility always exists that no consensus is reached in negotiations. This is not to say that consensus will never be reached, but it does affect the expected outcomes of negotiations in the medium long run. The feasibility of the creation of an agreement cannot be left out when discussing the potentials of international

cooperation. As a rule of thumb, the more participating parties, and the more diverging the preferences, the lower the feasibility of the negotiations ending in consensus.

In an analysis of the role that TK plays in international diplomacy, Dutfield (2001) discusses WIPO and TRIPs as possible forums for IP protection of TK. He notes that as early as 1984 WIPO and UNESCO organised a meeting to explore the possibilities for an international agreement on folklore. Dutfield describes that the participants were unable to reach an agreement and the proposal for a treaty was withdrawn. In a later attempt of the WIPO, through the Global Intellectual Property Issues Division (GIPID), emphasis shifted towards fact finding missions. According to a commentator[250] this is partly due to the fact that the US would only support the GIPID, if it would limit its mandate to not set norms, and therefore the creation of a treaty was blocked. It seems that negotiations on an international form of TK protection are still out of reach in this forum, due to the differences of opinions of the various member-states, and the lack of willingness to commit.

Dutfield's analysis of the TRIPs, and the international TK diplomacy, is more elaborate. He notes that developing countries have a number of grounds for dissatisfaction with TRIPs, which is supported by Cottier and Panizzon (2004), who claim that developing countries accepted TRIPs' overall package only to include a pledge to liberalize market access for agriculture and textiles. They state that the present form and scope were accepted only for that reason, as they primarily respond to the needs of industrialized countries. TK was one of the issues which was placed prominently on the negotiating table by developing countries. Dutfield discusses several proposals for (mandatory) protection of TK[251]. Dutfield concludes that it seems highly unlikely that a TK-protection framework will become part of TRIPs anytime soon. As the US were determined to block such a WIPO convention earlier, they are not expected to be inclined to consent with any such framework in the foreseeable future. Dutfield forewarns that TK will be used as negotiating leverage by the developing countries that put the TK issue on the map in the first place. He foresees that the TK-protection issue will be easily sacrificed by negotiators, once concessions in other areas of TRIPs, or broader trade-related issues, are secured. He therefore concludes that TRIPs and the WTO are not appropriate forums to solve the TK issues on.

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[250] As described by Halewood (1999).

[251] Dutfield refers to WT/GC/W/282 of Venezuela, WT/GC/W/302 of The African groups, and WT/GC/W/362 by Bolivia et al.

Whether or not the gloomy view of Dutfield is justified, he has a point that in the WTO TK-issues form only a small part of the overall trade negotiations. Adjustments to TRIPs can only be made when there is consensus on all adjustments discussed, between all member-states. This does not mean that it is impossible to form a TK-protection framework within TRIPs, as long as there is no consensus on other issues, but it does affect the feasibility of consensus arising on the subject. So a position on one certain topic can also serve as leverage in negotiations on another topic. This negatively affects the feasibility of a consensus arising in such a controversial agreement as TRIPs, and the current state of negotiations in the Doha round. If one leaves TK-protection to the international community, this means that it can still take a very long time before such a framework comes into existence. Other international forums for establishing such a TK-protection framework, such as the WIPO, would still need to find consensus of all participating member-states. Such consensus is not impossible, that is proven by the vast body of international agreements that currently exist, but the effectiveness of such agreements is often debatable. Reaching an agreement can take a long time, and with that can be rather inefficient. Exemplary is the current Doha-round of negotiations in the WTO, which began in 2001, and it is not very likely that these negotiations will be resolved in the near future.

It occurs that some countries postpone the adoption of domestic legislation, due to the fact that there are discussions on the topic on an international forum. If these international discussions then go on for a long period of time, no regulation on the subject is adopted at all (whether based on national decisions or on international), which in turn affects the efficiency with which these countries deal with the topic.

This results in the conclusion that it is difficult to perceive that an international framework of TK-protection will be able to come into being in the near future. This makes the international approach less feasible than a national approach.

4.5.6.1. The feasibility of an international integral framework of protection for TK

For negotiations on a framework of protection for all forms of TK the preferences are diverging widely, which lowers the feasibility of such a framework being created. This is what is currently happening at the WIPO. Even if negotiations are held with only countries that want to set up a binding framework of protection, the preferences still vary largely, as shown in Chapter 3. Even if the agreement would be non-binding, and hence does not

hinder countries in implementing their preferred legislation, countries seem reluctant to agree to such a non-binding agreement. Reasons for this include that this lowers the chances of another agreement being created that is in line with the country's preferences. This leaves the feasibility of the creation of a framework of protection very low.

For the approach specific possibilities, as a rule of thumb, the newer and the more controversial the instruments are that are needed for a framework of protection the more difficulties can arise in reaching consensus. When approach specific negotiations are done between countries that are seeking a protection within that specific approach, this drastically improves the feasibility of the creation of such a framework.

4.5.6.2. The feasibility of an international agreement following the economic empowerment approach

For economic empowerment this means that a framework for medicinal treatments is relatively feasible, as such a framework only uses concepts and regulations of treatments that are already widely in place in domestic regulations. Also little compromise is required regarding the specific contents of such regulations, and therefore not many obstacles are expected in reaching consensus between participating countries.

A framework for knowledge on medicinal uses is expected to be more difficult to be created, as there are more details and unknown factors to factor into the negotiations. But as it will originally be drawn up by, and applied in countries looking for such a form of protection it is certainly not unfeasible that consensus can be reached.

4.5.6.3. The feasibility of an international agreement following the preservative protection approach

For preservative protection the same reasoning goes as for economic empowerment. For defensive commercial interests, placing folklore in the public domain, there is no controversy between countries and consensus is highly feasible. For a sui generis right more uncertain factors are to be taken into account, but as it would only concern states looking for a sui generis right, with similar interests, consensus is not infeasible.

4.5.6.4. The feasibility of an international agreement following the cultural integrity approach

The subject matter of sacred culture is highly controversial, ideas differ on what should be considered sacred or offensive, and what not. However, for sacred culture a framework of protection is expected to consist of soft law, and non-binding standards. Agreement on

non-binding standards is much less controversial than agreement on binding standards. Consensus is therefore not very straightforward, but also not unfeasible.

Both for historical objects and for authentic objects the concept of regulating or restricting the content of trademarks and labelling, or what one is allowed to do with objects of great historical value, is not very controversial. Accepting the restrictions of other countries however, regarding the names and labels that they want to have protected can be more controversial. What ethical concerns exactly entail can differ between countries, but given the fact that such a framework would be drawn up by countries seeking the creation of such framework, consensus is not very easy, but not unfeasible.

Figure 17. Feasibility of the creation of an international framework

Diseconomies of scope		**Feasibility of reaching an international agreement**	
Integral TK		Diverging preferences	Low
Econ.	Products	New right to be created, but similar preferences	Medium
Emp.	Services	Non-controversial, participation non-restrictive	High
Pres.	Defensive com.	Non-controversial, participation non-restrictive	High
Prot.	Interests		
	Ethical concerns and active com. Interests	New right to be created, but similar preferences	Medium
Cult.	Sacred culture	Highly controversial but non-binding, and hence non-restrictive	Medium
Int.			
	Historical objects and authentic objects	Some controversy, but similar preferences	Medium

4.6. Identification of opportunities and challenges for international agreements on TK – conclusion

As the previous analysis shows, at the moment there are no existing international frameworks that provide binding standards regarding the protection of TK. Expectations for the creation of such international frameworks are low. Regional frameworks have also not succeeded to provide proficient protection of TK yet, not have international

negotiations on TK other than biological knowledge. Part of the reason for this seems to be the broad scope on which the negotiations take place. Negotiations seeking to regulate too many different forms of TK in one framework leads to a breakdown of the negotiations. Narrowing the scope of negotiations to more specific forms of TK has not been done yet. This paper argues a narrowing of the scope of negotiations could lead to more successful outcomes. One exception to this is the negotiations on biological knowledge. The fact that this is the only part of TK on which separate negotiations have been held, and that these are also the only negotiations that have achieved some success in the form of consensus supports this claim.

National legislation can provide effective protection up to a degree, but an international framework has the potential to be more effective and more efficient. However the creation of an international framework also has its setbacks, which can minimize these benefits or result in inefficient or ineffective regulations. This paper clarifies the benefits of international frameworks of protection for TK and the potential challenges. The feasibility of reaching consensus is also taken into account. The conclusion is that protection of TK can be provided more effective and efficient through international negotiations for some forms of TK when one does not seek to create one overarching framework of protection for all forms of TK, but when one splits up the negotiations per specific form of TK. Some forms of TK have more to gain from an international framework than others, and some are best left to the national legislator.

Based on the aforementioned aspects, and their effects on the protection of TK, predictions can be made about the potential opportunities and challenges for international agreements on the protection of TK, whether done in one all-encompassing integral framework, or through approach specific negotiations.

The creation of an international integral framework of TK protection is not very likely. Even if it were created it would not be much more effective than national frameworks, nor is there much to be expected in efficiency gains. The concept of TK is just too diverse, the preferences regarding its protection too multidimensional and too diverging for an international framework of protection to be formed. This is part of the explanation why the negotiations in both the WIPO and the WTO are not expected to lead to the formation of any such framework.

Splitting TK up into approach-specific negotiations is more likely to lead to consensus. And the agreements will be more effective and efficient than an integral framework protecting TK as a whole.

Within economic empowerment, reaching an agreement on TK of medicinal uses might pose a challenge, but it would not be impossible. An international framework would significantly increase the efficiency of the protection. However, when only countries participate, which seek to create such a framework, this will not prevent biopiracy in non-participating countries. As biopiracy is an international problem and mainly happening outside of the borders of the countries in which the TK originates, such an approach specific agreement between participating countries would only increase the effectiveness of the protection to some extent. It would, however, still be an improvement over national development of frameworks of protection.

For TK on medicinal treatments the benefits of an international framework of protection are not very large. It is not expected to significantly increase the effectiveness, nor the efficiency of protection. An international framework will not add much value to the protection of traditional medicinal treatments, compared to national frameworks.

Within the preservative protection approach for the protection of defensive commercial interests an international agreement is not needed for effective protection. However, international cooperation on a central database can lead to a more efficient way of protection.

For the protection of ethical concerns and active commercial interests, an international framework of protection can lead to an increase in efficiency. However, compromises will have to be made, which can lead to losses in effectiveness for some of the participating countries. Taking this into account, it might pay off to hold off an international framework of protection just yet, to allow national legislators to develop sui generis rights independently. This can lead to a better grasp of the ways in which ethical concerns and active commercial interests can be protected most effectively.

Within the approach of cultural integrity, for sacred culture it is not very likely that an international agreement will lead to binding standards. However, soft law to protect sacred culture will be significantly more effective when done through international cooperation.

The protection of historical objects will benefit from an international agreement as it can increase effectiveness to some degree, with a slight increase in efficiency as well. However these benefits will not be major, which is why this specific form of TK protection may not be at the top of the priorities list of the international negotiators.

For the protection of authentic objects, there is large potential for an international framework of protection. The protection can be provided more effectively when applied across borders. However, compromises will have to be made on what subject matter falls

under the protection. Binding minimum standards for a sui generis right will still allow some flexibility to countries, to minimize the loss of effectiveness in that sense.

5. A Generalized Jury Theorem

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ABSTRACT

The literature on information-aggregation based on the Condorcet Jury Theorem focuses on binary choices. By applying well-known statistical methods to this issue, we develop a framework of analysis capable of dealing with a broader set of choices, including choices over a continuum. We obtain two main results. First, we prove a Generalized Jury Theorem, including the Condorcet Jury Theorem as a special case. Second, we show that the Generalized Jury Theorem (rather than the Condorcet Jury Theorem) should be used to model the behaviour of jurors, when jurors have a common goal and communicate before voting; the reason is that our framework allows for more efficient aggregation of information than the traditional framework. Our findings are illustrated by means of concrete applications.

5.1. Introduction

Although decision-making is often a prerogative of groups of individuals - such as parliaments, expert committees and collegial courts - groups have no knowledge of their own and rely on information supplied by their members (Hayek 1945,p. 519; List and Polak 2010). Concern for the fact that the aggregation of individual bits of information into a collegial decision is a crucial determinant of the quality of the latter made its first recorded appearance in the work of Ramon Llull (ca. 1232-1316). Llull saw voting as a procedure for aggregating imperfect individual interpretations of God's will into a collegial decision - such as the election of a new Pope - in contrast with his predecessors (such as Aristotle and Pliny the Yonger) and a long list followers (starting with Nicolaus Cusanus), who looked at voting procedures as mechanisms to aggregate conflicting interests or preferences (McLean et al., 2007). This contrast is exemplary of the current approach in the literature on collegial decision-making, distinguishing between information aggregation and preference aggregation. The first formal framework for the study of the information-aggregation properties of collegial decision-making was developed by Condorcet (1785) centuries after Llull. Condorcet considered a group facing a simple binary problem, in which either of two choices is correct, and devised a method to formalize the aggregation of individual information into a collegial decision. This simple, yet very powerful approach attracted some attention in the social sciences in the late 40s and 50s, in connection with Duncan Black's rediscovery of the writings of Condorcet (Black 1948, 1958), and became known as the *Condorcet Jury Theorem*.[252] The theorem entails that a group is more accurate than its members - in that it makes the correct choice with a higher probability - that this probability increases with the size of the group and the accuracy of its members and that it approaches 1 as group size approaches infinity. While Condorcet's contribution to preference aggregation (his voting paradox) became immediately popular, his Jury Theorem lay quiescent for the following two decades and saw steep increases in popularity only in the early 90s and again in recent years.[253]

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[252] Before Black's rediscovery, Condorcet's Jury Theorem had only attracted the attention of fellow mathematicians, such as Laplace and Poisson; see Grofman (1975), p. 99 and Grofman et al.(1983) p. 286.

[253] Data gathered using Google Books Ngram Viewer, which shows the frequency of book citations of chosen *n-grams* (a string of characters interrupted by *n*-1 spaces), such as “Jury Theorem” and “voting paradox”, in a corpus of over 5 million books (about 4% of all books ever published). The data is obtained by searching for “Jury Theorem” and “voting paradox”. Search is case-sensitive but similar figures are obtained for “Condorcet Jury Theorem”, “Condorcet jury theorem”, or “Voting Paradox”. See Michel et al. (2011) for details on the quantitative analysis of culture using this corpus of digitalized books.

The steady increase in academic interest for information aggregation and, more broadly, for the tools of information economics has been taken as a sign of an ongoing "informational revolution" within formal political theory (Piketty, 1999,p. 791), gravid with numerous and wide-ranging implications for our understanding of legal and political institutions (e.g., Austen-Smith and Banks, 1996). The Condorcet Jury Theorem has been applied to the study of such diverse problems as the epistemic value of democracy (e.g., Grofman and Feld, 1988; Estlund et al., 1989; Young, 1988), collegial courts (e.g., Kornhauser and Sager, 1986; Coughlan, 2000), the information-revelation (expressive) function of the law (Darmapala and McAdams 2003), and multilevel governance (e.g. Arcuri and Dari Mattiacci 2010).

However, despite the intense efforts devoted to extend the Jury Theorem far beyond Condorcet's original formulation,[254] virtually all analysts have remained faithful to Condorcet's - and, before him, Llull's - original focus on discrete and, almost universally, binary decisions (the few contributions dealing with more than two options include Young 1998, Lam and Suen 1996, and List and Goodin 2001 and Ben-Yashar and Paroush 2001). In reality, many decisions involve a plurality and, often, a continuum of possible options: the determination of a damages award or of the length of a prison sentence, the setting of emission standards for polluting industries or of speed limits on highways, and the choice of a mandatory safety device in aviation or of a standard in the telecommunication industry are all collegial decisions that involve a continuum of possible alternatives. Using tools borrowed from estimation theory and statistics, we show that the insights offered by Condorcet's Jury Theorem can be obtained in a much more general and versatile setting - what we name the *Generalized Jury Theorem* - which contains Condorcet's version of the theorem as a special case and can be also used to model decisions over a continuum of options.

Our setup leans on recent results indicating that if jurors with identical preferences share a common goal and are given the possibility to communicate prior to voting - as is the case for committees of experts, collegial courts, criminal and civil juries - they reach a unanimous verdict which optimally incorporates all information available (that is, there is

[254] The literature on the extensions to the Condorcet Jury Theorem is particularly rich with respect to heterogeneity among jurors (Feld and Grofman 1984; Boland, 1989; Owen et al. 1989; Ben-Yashar and Nitzan 1997; Paroush 1998; Berend and Paroush 1998; Kanazawa 1998; Fey 2003; Karotkin and Paroush 2003) and dependency among jurors (e.g., Shapley and Grofman 1984; Boland et al. 1989; Berg 1993, 1994; Ladha 1992, 1993, 1995, McGinnis and Rappaport 2008). but also extends to other issues such as the effect of varying priors and expertise and different probabilities for type-I and type-II errors (e.g., [Nitzan and Paroush 1982, Kirstein and Wangenheim 2010).

full revelation in equilibrium) irrespective of the voting rule formally used (Coughlan 2000, Austen-Smith and Fedderson 2006).[255] However, as we show, in the traditional Condorcet Jury Theorem information is aggregated inefficiently as compared to the Generalized Jury Theorem; therefore, the latter offers a better way to model decisionmaking in pure information-aggregation settings.

Our framework of analysis offers two main analytical advantages, which we first prove in their most general form and then illustrate by means of concrete applications. First, our formulation of the jury theorem is not restricted to binary alternatives, rather it can be applied to a broad set of scenarios obeying some specified properties. To demonstrate how the theorem can be used in different cases, we first apply it to approval decisions, thereby replicating the results of the Condorcet Jury Theorem and showing that it is a special case of the Generalized Jury Theorem. Then we apply the theorem to the setting of standards, where the choice is from a continuum.

Our second result concerns the efficient use of the available information. Condorcet's traditional framework implies the loss of relevant information on the reliability of the collegial decision; this information is available to the jurors but is somehow not embedded into the final decision. For example, if two five-person juries have taken two different decisions---say, jury A has chosen 1, while jury B has chosen 0, the Condorcet Jury Theorem treats them in the same way and is only concerned with the probability that each decision is correct, which is the same for both juries. However, the two decisions may be quite different. For instance, jury A might have unanimously chosen 1, while jury B might have chosen 0 with a majority of 3 to 2. Intuitively, jury A's decision is more reliable than jury B's decision. Taking this information into account has crucial effects in representative systems. It has been argued that representative majority is less efficient in aggregating information than direct majority (Boland 1989). We show that this result needs to be qualified when all the available information on the reliability of decisions is taken into account. Furthermore, reliability can also be an issue when the jurors' level of expertise varies. We show how the Generalized Jury Theorem can handle this case.

[255] Ben-Yashar (2006) shows that, in a dichotomous choice framework without communication, informative decisionmaking is a Nash equilibrium if the optimal decision rule is chosen. The optimal decision rule is defined in Ben-Yashar and Nitzan (1997) as the rule that maximizes the probability of taking the good decision in an environment where jurors' expertise and priors are allowed to vary.

This paper is structured as follows. In Section 5.2 we present our framework of analysis. In Section 5.3 we prove our main result and, in Section 5.4, we present two sets of applications. In Section 5.5, we conclude.

5.2. Model: information-aggregation as sampling

The model that we present in this section is based on the observation that information-aggregation by juries can be seen as a sampling procedure, where the sample (the collection of information possessed by the individual jurors) is used to estimate the value of an unknown parameter $\theta \in \Theta$ (where Θ is an open interval) of a given statistical distribution. The decision taken by the jury is then based on its estimate of the parameter. The distribution used in the model could be a Bernoulli distribution (the traditional Condorcet framework for approval decisions), a normal distribution (which could be used for the setting of standards), or another distribution, depending on the type of decision the jury is asked to take.

The timing of the decisionmaking process is as follows: at t_0 Nature (or a higher authority) assigns a certain type of decision to a jury; this determines the type of distribution used in the model and the true value of the parameter θ. At t_1 jurors receive private information on what should be the correct decision, this information is correlated with, but not necessarily equal to θ and is drawn from the distribution determined at t_0. At t_2 the jury deliberates over the decision, that is, jurors discuss the issues and can reveal the signals they have received in a non-verifiable way (cheap talk). Finally, at t_3 the jury takes a vote on the final decision.

5.2.1. The correct decision (common goal)

The jury is asked to decide on an issue for which there exists a "correct" decision,[256] that is a decision that at some point in the future will yield the highest payoff for society. This correct decision is not known ex ante and is a function of the unknown parameter θ. Note that θ is the only unknown in the model, while all the rest is common knowledge: decisionmaking for the jury is in essence an estimation of the value of θ. To keep the focus on information-aggregation, we assume that all jurors have identical preferences and the common goal of striving to implement the correct decision; more specifically, the jurors' aim is to take a decision that is unbiased and as accurate as possible - we will define both

[256] See Young (1998, p. 1232) for a discussion of the notion of correct decision in a political context and Egeland (2011, pp. 337-339) for a critical view.

terms below - in which case they receive at some point in the future - when uncertainty concerning the parameter will be dissipated---positive utility, they receive zero otherwise.

5.2.2. Jurors and signals.

There are $n > 2$ jurors on the jury. Each juror, denoted as $i = 1, \ldots, n$, observes a private signal (a piece of information), $X_i \in S \subset \mathbb{R}$, where S is the set of available signals. As in the traditional setting, we assume that jurors are identical with respect to their ability to gather information,[257] and that they are independent from each other, that is, we assume that all signals are independent random draws from an identical statistical distribution with density $f_{(X_i,\theta)}(x)$ (if the distribution is continuous) or $P_{(X_i,\theta)}(X_i = x)$ (if the distribution is discrete). The distribution depends on the unknown parameter θ and hence the signals the jurors receive carry information that can be used to estimate the correct decision. A standard measure of how much information about the parameter is embedded in each signal is given by the Fisher information

$$I(\theta) \equiv E\left[\left(\frac{\delta \log f(X_i;\theta)}{\delta\theta}\right)^2\right]$$

or

$$\equiv E\left[\left(\frac{\delta \log P_{(X_i,\theta)}(X_i = x)}{\delta\theta}\right)^2\right]$$

(depending on whether the distribution is continuous or discrete). The greater $I(\theta)$, the more information can be inferred from each signal.[258]

5.2.3. Unbiasedness and accuracy of the jurors.

In the traditional framework it is also assumed that jurors are unbiased; here this means that, on average, they receive a correct signal: $E(X_i) = \theta$ for $i = 1, \ldots, n$. In each specific case, however, a juror's information may well differ from the true value. The variance $Var(X_i) > 0$ of the signal measures how much a juror's signal will differ on average from θ. Therefore, we can construct an accuracy index $a_i \equiv \frac{1}{1+Var(X_i)} \in (0,1)$ which is high if the variance of the distribution of signals is small and hence the signals are clustered very tightly around θ and will typically differ very little from it (jurors are very accurate). In

[257] We assume implicitly that information is gathered without costs by the jurors; in the real world, it will typically be important to provide incentive to collect costly information (Beniers and Swank 2004, Dewatripont and Tirole 2009).

[258] See Rise (2007, pp. 255-312).

contrast, a_i is low if the variance is large and the signals are dispersed around θ (jurors are not very accurate). Note that the assumption made above that the signals are drawn from the same distribution implies that $Var(X_i) = \cdots = Var(X_n)$ and, hence, that all jurors are identically accurate: $a_i = a$, for all $i = 1, \ldots, n$.

5.2.4. The jury decision

Jurors have a common goal, are unbiased and there is no uncertainty concerning their preferences. Thus, during the deliberation round, it is a Nash equilibrium for jurors to truthfully reveal their signals and, during the voting round, it is a Nash equilibrium to vote unanimously for the outcome that, given the signals, best approximates θ (deviations from this outcome can only reduce the jurors' utility; (McLennan 1998, Coughlan 2000, Austen-Smith and Fedderson 2006). For a large set of possible distributions there exists a uniformly minimum variance unbiased (UMVU) estimator, that is, an aggregation of the individual signals in a way that produces an approximation of the true value that is both unbiased and as accurate as possible.[259] By focusing on the set of distributions that have a UMVU estimator, we can take the jury decision to be equal to the UMVU estimator of the correct decision and denote it by $\hat{X}_n$. As we did for jurors, we can construct an index representing the accuracy of the jury decision: $A \equiv \frac{1}{1+Var(\hat{X}_n)} \in (0,1)$.

5.2.5. Framework

This framework of analysis generalizes the applicability of the core ideas behind the traditional Jury Theorem to a broader set of decisions. In particular, it provides a way to think about accuracy of a juror's signal and of the jury decision even when there is a continuum of possible alternatives and hence it would be meaningless to talk about the probability that the signal or the decision is exactly equal to the correct decision. Moreover, when there are more than two alternatives, the notion of accuracy proposed above allows us to capture the fact that a decision might be different from the correct decision - and, thus, strictly-speaking wrong - but nevertheless very close to it and hence preferable over other options. Figure 18 shows how notions used in information-aggregation models are paired with notions used in estimation theory in our model.

[259] This is an estimator that has the minimum variance possible for all values of the parameter.

Figure 18. Information-aggregation and estimation theory

		Interpretation	
		Information-aggregation theory	**Estimation theory**
Variables	n	Number of jurors (jury size)	Number of observations (sample size)
	X_i	Information (signal) of a juror	An individual observation
	a_i	The accuracy of juror *i*	An inverse function of the variance of observation *i*
	θ	The 'true' or correct decision	The parameter value to be estimated
	$\hat{X}_n$	The jury decision	The estimator of θ
	A	The accuracy of the jury	An inverse function of the variance of the estimator

5.3. The Generalized Jury Theorem

Here we focus on jury decisions that can be represented by a parametric distribution having two important properties. The first property concerns the existence of an unbiased estimator with the minimum possible variance. This is important because the minimum possible variance of an estimator is known and corresponds to the Cramér-Rao lower bound, $\frac{1}{nI(\theta)}$.[260]. Focusing on this class of distributions allows us to think of the jury decisionmaking process as a process of estimation that uses the available information in the most efficient way. In addition, a subset of these distributions has the very plausible property that the Fisher information increases with the accuracy of the jurors, $\frac{\vartheta I(\theta)}{\vartheta a} > 0$, indicating that if the jurors are more accurate, then the signals convey more information concerning the correct decision. We introduce the notion of *regular jury decisions:*

Definition. Regular jury decisions are jury decisions corresponding to the class of distributions that have two properties: a UMVU estimator that attains the Cramér-Rao lower bound exists and the Fisher information decreases with the variance of the distribution (which implies that it increases with the accuracy of the jurors).

Commonly used distributions satisfy these properties and we will provide two examples in the next section.

[260] If the Fisher information exists and is finite and if $Var(\hat{X}_n)$ is finite, then the Cramér-Rao lower bound implies that $Var(\hat{X}_n) \geq \frac{1}{nI(\theta)}$. Since we are focusing on distributions for which a lowest-variance estimator exists, then this lowest-variance estimator meets by hypothesis the lower bound and we have $Var(\hat{X}_n) = \frac{1}{nI(\theta)}$. See Rise (2007, p. 300) for a simple formulation of the theorem.

Generalized Jury Theorem. For regular jury decisions, we have:

1. A jury is more accurate than a juror;
2. A jury's accuracy increases with the accuracy of its jurors;
3. A jury's accuracy increases with the number of jurors;
4. The probability that the jury takes the correct decision approaches 1 as the number of jurors approaches infinity.

The Generalized Jury Theorem extends the results of the Condorcet Jury Theorem to a broad class of situations - all regular jury decisions - including cases in which the choice of the jury is over a continuum. The theorem captures a number of facts that become intuitively clear once the jury decisionmaking process is seen as a sampling procedure. The jury is comparable to a sample in the sense that it collects *n* different views or observations of the same unknown variable. The jury is more accurate than a juror simply because it relies on more information. The accuracy of the jury decision increases with the accuracy of the information brought in by the jurors: if the jurors' signals are more closely clustered around the correct decision, also the jury decision will be more accurate. Likewise, if we add jurors, we are increasing sample size and hence improving the accuracy of the estimation. If we had an infinitely large number of jurors, the jury would have enough observations to take the correct decision with nearly absolute precision. The proof of the theorem is in appendix 5.1.

5.4. Applications

In this section we present two sets of applications that illustrate our two main claims. First, we apply the Generalized Jury Theorem to two topical cases: approval decisions and the setting of standards. Approval decisions are the traditional binary setting on which most models in the literature on information aggregation are based; we use this case to show that the Condorcet Jury Theorem can be subsumed as a special case of our more general theorem. Next we examine the setting of standards, where the jury decision can take any value in a continuum. Secondly some assumptions are relaxed to show how the Generalized Jury Theorem can be valuable in illustrating the effects of optimal use of available information. The first application aims at illustrating our point that the traditional setting makes suboptimal use of the information available. To do so, we examine the informational efficiency of representative majority as compared to direct majority. The

second application shows what happens when the assumption of homogenous jurors is relaxed, and how the signals will be weighed to determine the optimal decision.

5.4.1. Binary decisions and decisions over a continuum

The application of the Generalized Jury Theorem to a specific jury decision reduces to a very simple procedure. It needs to be verified that the jury decision is regular in the sense described above. If this is the case, then the results of the theorem apply.

5.4.1.1. Binary decisions: the Condorcet Jury Theorem revised

The traditional Condorcet framework of analysis, which concerns decisions taken by a jury composed of $n > 2$ jurors over a binary choice (0 or 1). For simplicity, let us assume that 1 is the "true" value,[261] that is, the choice that the jury would make if it had complete information. Each juror *i* has a different piece of information, $X_i \in \{0,1\}$, but all jurors are equally accurate, in the sense that they have the correct information $X_i = 1$ with an identical probability $p > \frac{1}{2}$. Assuming that n is odd,[262] the jury chooses 1 if at least $\frac{n+1}{2}$. jurors have a signal equal to 1. Accordingly, the probability that the jury chooses 1 is commonly written as follows:

$$P_n(p) = \sum_{i=\frac{n+1}{2}}^{n} \binom{n}{i} p^i (1-p)^{n-i}$$

From this framework derives the following fundamental and well-known set of results:

Condorcet Jury Theorem

1. A jury is more accurate than a juror: $P_n(p) > p$;

2. A jury's accuracy increases with the accuracy of its jurors: $P_n(p)$ increases with p;

3. A jury's accuracy increases with the number of jurors: $P_n(p)$ increases with n;

4. The probability that the jury takes the correct decision approaches 1 as the number of jurors approaches infinity: $\lim_{n\to\infty} P_n(p) = 1$.

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[261] This simplification is without loss of generality as it only concerns the labelling of the two alternatives and can be reversed.

[262] If n is even, the jury chooses 1 if at least $\frac{n}{2} + 1$ jurors vote 1. Thus, with n even, the votes could be evenly distributed ($\frac{n}{2}$ for outcome 1 and $\frac{n}{2}$ for outcome 0); if this happens, the outcome is chosen at random with probability equal to $\frac{1}{2}$. For n even, the expression changes slightly due to the possibility of a draw in votes, but as the results are similar to n odd, the case for n even is omitted here. See Miller (1996, p. 175).

Note that the setting of the Condorcet Jury Theorem implies that the information available to the individual jurors is modelled as a random draw from a Bernoulli (p) distribution with an unknown parameter $\theta = p = \Pr(X = 1)$.[263]. Moreover, this decision is regular (a fact that we prove in appendix 5.2). The most accurate estimator of p is the mean of the signals received by the jurors; thus, the jury decisions can be described as $\hat{X}_n = \bar{X}_n \equiv \frac{1}{n}\sum_{i=1}^{n} X_i$. Furthermore, the accuracy of jurors can be written as $a = \frac{1}{1+p(1-p)}$, while the accuracy of the jury is $A = \frac{1}{1+\frac{p(1-p)}{n}}$. It is easy to verify that the claims of the Generalized Jury Theorem hold true here with respect to a and A.

The Generalized Jury Theorem applied to binary decisions is different from Condorcet's theorem in two respects. First of all, accuracy is measured in two different ways in the two theorems. However, this difference is only quantitative (we obtain different numbers as measures of accuracy) and the qualitative aspects of the theorem and their interpretation remain the same (these different numbers mean the same things and vary in similar ways). The second difference is more profound and concerns the nature of the jury decision. Under the Condorcet Jury Theorem, information is inefficiently aggregated, as the example given in the introduction shows. This difference is apparent when comparing the Condorcet Jury Theorem and our generalized setting. The jurors have exactly the same information in the two settings. However, in Condorcet's setting the aggregation of their individual signals is done by the median: the jury chooses the outcome with the largest number of signals; in the example given in the Introduction, jury B's decision is simply 0. In contrast, the Generalized Jury Theorem uses the mean: the jury averages the signals received. In this case, the mean is more informative (and in fact is the UMVU estimator) as it carries information on the reliability of the jury decision. The jury's information aggregation will result in an estimate of the probability p and hence will be a value between 0 and 1. In the example, jury B's estimate would be $\frac{2}{5}$. In general, once the jurors have estimated p using the mean, they can implement the following decision:[264]

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[263] The whole point of the exercise is that the parameter p is unknown. If a juror knew that he has a probability p to have the correct information and, at the same time, that the probability of having the information $X_i = 1$ is p, then he would automatically know that the correct decision is 1, which would make the uncertainty about the correct choice vanish. Thus, jurors must be ignorant of the parameter p or, at the very least, they must be uncertain as to which of the two outcomes p refers to; that is, it is admissible for the jurors to know that they have an individual probability p of having the correct information but they must be uncertainty as to whether p is the probability of $X_i = 1$ or of $X_i = 0$.

[264] In the following, we retain the assumption that n is odd; n even may lead to ties, but the results do not change.

$$\tilde{X}_n \begin{cases} 0 \text{ if } \bar{X}_n < \frac{1}{2} \\ 1 \text{ if } \bar{X}_n > \frac{1}{2} \end{cases}$$

It is easy to see that this is exactly the same decision taken under the traditional Condorcet framework, because the median is the integer closest to $\bar{X}_n$: If a majority of jurors votes 1, then the median is 1 and the mean is bigger than $\frac{1}{2}$; if a majority of jurors votes 0, then the median is 0 and the mean is smaller than $\frac{1}{2}$:

$$\Pr(\tilde{X}_n = 1) = \Pr\left(\bar{X}_n > \frac{1}{2}\right) = \Pr\left(\sum_{i=1}^{n} X_i \geq \frac{n+1}{2}\right)$$

$$= \sum_{i=\frac{n+1}{2}}^{n} \binom{n}{i} p^i (1-p)^{n-i} = P_n(p)$$

If the correct decision is 1, we have that $p > \frac{1}{2}$ and hence $P_n(p) > p > \frac{1}{2}$ as in the traditional CJT. The reverse holds true if $p < \frac{1}{2}$. Therefore, our framework replicates all the results of the traditional Condorcet Jury Theorem, but adds more information to the jury decision, because the mean embeds more information than the median. By looking at the median, the jury can only conclude whether either option is more probable to be the correct one; instead, by looking at the mean, the jury can also estimate the actual probability that a specific option is the correct one. This information is not always relevant, but we present a case below in which this is a crucial aspect of the problem.

5.4.1.2. Decisions over a continuum of choices

The traditional approach refers to approval decisions, but in reality many juries are called upon to choose among a continuum of possibilities. A way to formalize this scenario is to assume, as it is common, that the signals received by the jurors are normally distributed around the correct decision according to $\mathrm{N}(\mu, \sigma^2)$, where $\theta = \mu$ is the unknown value of the correct decision and $\sigma^2 = \mathrm{Var}(X_i)$ is the (known) variance of the distribution of signals. The juror's accuracy can be written as $a = \frac{1}{1+\sigma^2}$ and it indicates that a taller and narrower distribution is paired with more accurate jurors. Also this jury choice is regular (a fact that we prove in Appendix 5.3). With $\mathrm{N}(\mu, \sigma^2)$, the sample mean is again the UMVU

estimator of μ and has variance equal to $\frac{\sigma^2}{n}$; consequently, the jury's accuracy is $A = \frac{1}{1+\frac{\sigma^2}{n}}$.

The results obtained in the Generalized Jury Theorem can be easily verified.[265]

It is also interesting to note that using the UMVU estimator (the mean, in this case) yields a more accurate jury decision than would result under the Median Voter Theorem (Black 1948, Downs 1957). In the normal distribution, the UMVU estimator (the mean) and the median coincide but this is not generally the case with other distributions; therefore, in general, the Median Voter Theorem may entail an inefficient aggregation of information.

5.4.2. Optimal use of available information

The Generalized Jury Theorem rests on a framework that allows for an analysis of the optimal use of available information. In this section, we examine two related issues: the transmission of information when decisions are taken in multiple stages and the aggregation of information obtained by heterogeneous jurors.

5.4.2.1. Information transmission

Within the traditional Condorcet framework with a binary choice, (Boland et al 1989, pp. 86-87) show that "a direct majority system is always preferable to any indirect majority system of the same overall size". Indirect majority is a system in which the *n* jurors are distributed into *m* juries (denoted by an index *j*), each of size n_j. Accordingly, assuming for simplicity that $n_j = k > 1$ for all *j* (with *km*=*n*), the probability that jury *j* chooses 1 is:

$$P_k(p) = \sum_{i=\frac{k+1}{2}}^{k} \binom{k}{i} p^i (1-p)^{k-i}$$

At a second stage, the decisions of the *m* juries are aggregated into a grand-jury decision -for instance, each jury sends a representative who votes as instructed - whose probability of choosing 1 is:

$$P_{km}(p) = \sum_{j=\frac{m+1}{2}}^{m} \binom{m}{j} p_k^j (1-p_k)^{m-j}$$

[265] The first three claims are trivially verified by inspection of *a* and *A*; the fourth claim can be proven by the Lemma in appendix 5.1.

Boland et al. (1989) show that $P_n(p) > P_{km}(p)$ if $p > \frac{1}{2}$, that is, indirect majority has a deleterious effect on the ability of the system to aggregate information (see also Berg (1997), and Berg and Maranon (2001)). This result is due to the fact that the jury representatives carry less information than they have to the grand-jury meeting and this raises the question why the grand jury should not use information that its members have (and are willing to reveal). Figure 19 presents an example in which 15 jurors are subdivided in 3 juries. It shows that a direct system would implement the decision 1 while an indirect system would implement the choice 0.

Figure 19. Direct versus indirect majority

	Votes for 0	**Votes for 1**	**Choice**
Jury A	0	5	1
Jury B	3	2	0
Jury C	3	2	0
Total	6	9	1

The problem is that, at the grand-jury level, the information used at the jury level is no longer available. A unanimous decision counts as heavily as a 3 to 2 majority once we are a level up. The Generalized Jury Theorem allows us to examine the efficiency of indirect majority systems when the available information is fully used. If juries were to report their means instead of simply their final decision, then jury A would report 1, while juries B and C would report $\frac{2}{5}$. The grand jury decision would again be a mean: $\frac{1}{3}\left(1+\frac{2}{5}+\frac{2}{5}\right)=\frac{9}{15}$. Since the mean is closer to 1 then to 0, the grand jury would implement 1. No information is lost in this case. In general, each jury *j* consisting of n_j jurors provides an estimate of p by using the mean of the signals received, so that the jury decision is $\bar{X}_n = \frac{1}{n_j}\sum_{i=1}^{n_j} X_i$. Each jury's representative will bring this information (and not simply a 0 or 1) to the grand-jury meeting. Again, the grand jury will decide using the average of the jury decisions and using jury size as weights:[266]

$$\bar{X}_{n_j m} = \frac{1}{n}\sum_{j=1}^{m} n_j \bar{X}_{n_j} = \frac{1}{n}\sum_{j=1}^{n} X_i = \bar{X}_n$$

In the specific case discussed above of juries of equal size $n_j = k$ we have $\bar{X}_{km} = \bar{X}_n$. In essence, by relying on the efficient estimator, the grand jury takes into account all the

[266] The same exercise could be repeated for decisions over a continuum.

information available to the jurors, that is, all the signals, and hence takes the same decision that would have been taken under a direct majority system. Indirect majority systems do not result per se in a loss of information and hence of accuracy. Such events may still occur but are not due to any intrinsic failure of the system in aggregating information but rather to a failure of the system in transmitting information from a level to the next.

5.4.2.2. Information processing

So far we have assumed that each bit of available information is equally reliable, and hence is treated in the same way in the processes of information aggregation and decisionmaking. However, individual jurors may well differ in the accuracy of the information they gather. Translated to our framework, this means that jurors can have different variances of their signals, which results in each juror having different individual accuracy indices a_i. If individual accuracy is common knowledge, the effect of heterogeneity among jurors on the decisionmaking process is that the UMVU estimator changes to a weighted aggregation of the signals.

For decisions over a continuum of choices, where the signals of the jurors are normally distributed around the correct decision according to $\mathrm{N}(\mu, \sigma_i^2)$, the UMVU estimator assigns weights $\frac{1}{\sigma_i}$ to each signal. So that the jury decision becomes

$$\check{X}_n = \frac{1}{\sum_{i=1}^{n} \frac{1}{\sigma_i}} \sum_{i=1}^{n} \frac{X_i}{\sigma_i}$$

We show in appendix 5.4 that, in essence, this means that heterogeneity of jurors can be handled within the Generalized Jury Theorem. The available information can be processed such that it puts the highest weights on the most accurate signals, without completely discarding less accurate information.

5.5. Conclusions

We have presented a generalized framework of analysis that includes and extends the Condorcet Jury Theorem and can serve as a basis for the analysis of a broad set of information-aggregation problems. We have shown how this framework can be applied in a selected set of cases. Our framework has the advantage of being able to deal with non-binary problems, such as decisions over a continuum of possibilities, and of making efficient use of the available information. In addition, proofs based on the Generalized Jury

Theorem are much shorter and less involved than the discrete mathematics necessary to solve problems within Condorcet's original setting. The problem of generating Condorcet-like results for a specific jury decision is reduced to two steps: find an estimator that meets the Cramér-Rao lower bound and show that the Fisher information decreases with the variance of the distribution. This property may be useful in the study of extensions of the model. As a possible application to institutional design the Generalized Jury Theorem could improve and simplify the method to determine the optimal size of a jury to maximize wealth, in a situation of administrative costs or costly information. It would allow for a simplification of cost benefit analyses regarding uncertain decisions by juries. Many factors, which we have not considered, may bear on the results obtained in our generalized framework. Future research could consider the cost of acquiring information, drop the assumption of independence among jurors, and consider the effect of biases or different preferences, among other issues.

6. Conclusions and future research

The main conclusion or message of this dissertation is that economic analysis can allow for new valuable insights when applied to legal issues. I have tried to show the variety of ways in which a single doctrine (law) can benefit from opening up to techniques from another doctrine (economics), but I believe that most academic fields could benefit from looking over the fence and opening up to research in other fields. Interdisciplinary research can introduce methods, theories and approaches that are new to the field in which they are used. There is a wealth of knowledge out there in various disciplines, which interdisciplinary research can tap into.

Further research linked to this broad central theme of promoting interdisciplinary research is potentially obvious, but not necessarily straightforward. More specifically to the topics discussed in this dissertation the direction for further research can be described more directly.

For the topic of comparative negligence further research could look into the rationale that was provided by legislators or judges when comparative negligence was introduced as a rule. Also behavioural research into the decisionmaking of individuals when faced with potential negligence situation would allow for insights that is valuable both for researchers and for policy makers. For institutional application in specific situations such as speed limits and safety rules in traffic a quantification of potential damages and costs of care could help policy makers decide on optimal traffic rules.

In the field of TK there is still a lot of further research to be done. This is a relative uncharted topic and a more elaborate understanding of the underlying historical, cultural and political reasons for countries to choose a specific approach would be insightful. Further research into the de facto status of TK protection vis à vis the de jure status could also be of importance to a better understanding of the status quo.

When it comes to international negotiations on TK protection a comparison between countries' negotiating positions and contributions on the one side and the legal reality within their own domestic jurisdiction could be insightful. The difference between what countries 'practice' and what they 'preach' can show underlying motives that are at play.

Further research applying the Generalized Jury Theorem could be in the determination of optimal jury sizes. It would allow for simplification of cost benefit analysis in a situation of administrative costs or costly information. Future research could consider the cost of

acquiring information, drop the assumption of independence among jurors, and/or consider the effect of biases or varying preferences.

Appendices

Appendix 2.1 Solution of the discrete game

Consider the case in which $\tilde{P} > \frac{X+Y}{L} \geq P$: care is not socially desirable but the court will find a party that did not take care negligent. Under simple or contributory negligence, there is a unique Nash equilibrium in which both parties take care if the following two conditions are satisfied $X < PL$ and $Y < PL$. This Nash equilibrium is socially inefficient because $X + Y > PL$. Under comparative negligence with relative fault a second equilibrium arises where both parties fail to take care if the following two conditions are satisfied: $X > \frac{X}{X+Y} PL$ and $Y > \frac{Y}{X+Y} PL$. Note that these two conditions can be rewritten as $X + Y > PL$, which is true by hypothesis. Therefore, under comparative negligence with relative fault there is a second Nash equilibrium in which both parties are negligent. This Nash equilibrium is socially optimal and is more likely to be selected than the compliance equilibrium because it entails less costs for both parties – it is the Pareto efficient equilibrium and hence a focal point. Mixed strategy equilibria may also arise but they entail higher costs for the parties and for society than the efficient negligence equilibrium and are unstable. Instability can be easily checked by noting that a slight change in a party's probability of taking care makes the other party switch from a mixed to a pure strategy. Moreover, the mixed strategy equilibrium is evolutionary unstable, which can be verified in a simple dynamic setting.

Appendix 2.2 Proof of Lemma 1

We consider two possible ways in which parties can deviate from due care. One could take less care than required (which qualifies as a violation of the standard and hence as negligent behaviour) or one could take more care than required, which is a deviation from the due-care standard but does not qualify as a negligent violation. These two possibilities give rise to three possible kinds of equilibria.

1) Both parties are non-negligent. Assume that $(x^* \geq x^d, y^* \geq y^d)$ is an equilibrium. The injurer has no incentive to take more care than the due-care standard, since he does not bear the damages, so he takes $x^* = x^d$. The victim takes a level of care that minimizes $l(x^d, y) + y$; hence, if the victim chooses $y^* \geq y^d$ it must be the case that $l(x^d, y^*) + y^* \leq l(x^d, y^d) + y^d$. Adding x^d to both sides and substituting $x^* = x^d$ into the left-hand side, we obtain $S(x^*, y^*) \leq S(x^d, y^d)$.

2) One party is negligent, while the other is non-negligent. Assume that either $(x^* \geq x^d, y^* < y^d)$ or $(x^* < x^d, y^* \geq y^d)$ is an equilibrium. Consider the latter case, in which the injurer is negligent. This outcome can only be an equilibrium if the injurer has no incentive to deviate, thus $l(x^*, y^*) + x^* \leq x^d$. This inequality implies $l(x^*, y^*) + x^* \leq l(x^d, y^*) + x^d$; adding y^* on both sides, we have $l(x^*, y^*) + x^* + y^* \leq l(x^d, y^*) + x^d + y^*$. It is easy to see that the non-negligent party (the victim) has no incentive to take more care than the due-care standard, since he does not bear the damages. We can substitute $y^* = y^d$ into the right-hand side and obtain $S(x^*, y^*) \leq S(x^d, y^d)$. The same applies to the symmetric case in which the victim is negligent.

3) Both parties are negligent. Assume that $(x^* < x^d, y^* < y^d)$ is an equilibrium. This can only be the case if

$$[7] \quad \sigma l(x^*, y^*) + x^* \leq x^d$$

$$[8] \quad (1 - \sigma) l(x^*, y^*) + y^* \leq y^d$$

Summing up inequalities [7] and [8], we have $l(x^*, y^*) + x^* + y^* \leq x^d + y^d$ which implies $S(x^*, y^*) < S(x^d, y^d)$. In all cases we have that if (x^*, y^*) is an equilibrium, then the total social cost is less than it would be if both parties took due care: $S(x^*, y^*) < S(x^d, y^d)$. *Q.E.D.*

Appendix 2.3 Proof of Proposition 1

We have $l(x^*, y^*) + x^* + y^* \leq x^d + y^d \leq x^{**} + y^{**}$, where the first inequality comes from conditions [7] and [8], while the second inequality follows directly from the hypotheses of this proposition. This implies $S(x^*, y^*) < S(x^{**}, y^{**})$. *Q.E.D.*

Appendix 2.4 Proof of Corollary 1

Assume that $(x^{**} \geq x^d, y^{**} \geq y^d)$ is an equilibrium. The injurer has no incentive to take more care than the level of due care, since he does not bear the damages, thus he takes $x^{**} = x^d$. The victim takes a level of care that is greater than, or equal to due care ($y^{**} \geq y^d$), and it must be the case that $l(x^d, y^{**} + y^{**} \leq l(x^d, y) + y$ for all $y < y^d$, therefor $x^{**} = x^d, y^* < y^d)$ cannot be an equilibrium. Looking at the injurer, it must be the case that $x^d \leq l(x, y^{**}) + x \leq l(x, y^d) + x$, for $x < x^d$, thus $(x^* < x^d, y^* = y^d)$cannot be an equilibrium. *Q.E.D.*

Appendix 2.5 Proof of Proposition 2

The proof is articulated in the following two cases.

Case 1: Compliance is an equilibrium. If there is an equilibrium in which both parties take at least due care, then there cannot be a second equilibrium in which one party violates and the other complies (Corollary 1). The only remaining possibility is a second equilibrium in which both parties are negligent ($x^* < x^d, y^* < y^d$). The levels of care taken by the parties when they are both negligent satisfy

$$l_x(x^*, y^*) = -\frac{1}{\sigma}$$

$$l_y(x^*, y^*) = -\frac{1}{(1-\sigma)}$$

which implies that the chosen levels of care are functions of σ: $x^* = x(\sigma)$ and $y^* = y(\sigma)$. It is easy to verify that such levels of x and y, which satisfy both first-order conditions simultaneously, exist.[267] Moreover, an equilibrium where both parties are negligent emerges if, and only if, the conditions in equations [7] and [8] are simultaneously satisfied. Combining these two conditions, we obtain the range of possible values of σ given in equation [4] that support the equilibrium, where the upper boundary is condition [7] rearranged and the lower boundary is condition [8] similarly rearranged. The optimal liability rule is one that implements a value of σ within the range.

Case 2: Compliance is not an equilibrium. Subcase 1) is proven in the text. Concerning subcase 2), consider, for instance, a situation in which the standard for the injurer is set at the socially optimal level, $x^d = x^s$, while the standard for the victim is too high, $y^d > y^s$. If the harmis such that $l_{xy}(x, y) = 0$ (a party's socially optimal level of care does not depend on care taken by the other party), simple negligence induces both parties to take the socially optimal level of care. The resulting equilibrium is such that the injurer is non-negligent while the victim is negligent but takes $y^* = y^s$, as he pays the full accident loss in addition to his cost of care. Comparative negligence might induce an inferior outcome. Consider now a different situation in which both due-care standards are too high and the harm is such that $l_{xy}(x, y) < 0$ (a party's socially optimal level of care

[267] Consider the function $l(x, y) + \frac{x}{\sigma} + \frac{y}{1-\sigma}$ and note that this function is strictly convex and that it has first-order conditions identical to those in the text. Convexity implies that there exist levels of x and y such that these conditions are simultaneously satisfied. In order to focus on the interesting cases, we assume such levels of care to be positive.

increases with care taken by the other party). In this case, both simple and contributory negligence might induce equilibria in which both parties' care levels are greater than the social optimum, while comparative negligence might induce an equilibrium in which care by the parties is less than the socially optimal levels. Which one of these two equilibria is desirable depends on the characteristics of $l(x, y)$. In essence, which equilibrium emerges depends on the value of σ, but which equilibrium yields lower social costs depends on the characteristics of $l(x, y)$ and on the due-care standards set by the regulator. *Q.E.D.*

Appendix 2.6 Proof of Proposition 3

Assume that $(x^* < x^d, y^* < y^d)$. is an equilibrium. The range of values for $\sigma(x^*, y^*)$ in equation [5] is nonnegative if and only if $l(x^*, y^*) + x^* + y^* \leq x^d + y^d$. Rearranging and multiplying both sides by $(x^d - x^*)$ we obtain

$$l(x^*, y^*)(x^d - x^*) \leq [(x^d - x^*) + (y^d - y^*)](x^d - x^*)$$

or

$$\sigma(x^*, y^*) \equiv \frac{(x^d - x^*)}{(x^d - x^*) + (y^d - y^*)} \leq \frac{(x^d - x^*)}{l(x^*, y^*)}$$

which satisfies the upper boundary of the range in equation [5]. By a similar exercise one can show that the lower boundary is also met. To see that this rule is unique consider the case in which both conditions [7] and [8] are binding. This implies

$$l(x^*, y^*) = (x^d - x^*) + (y^d - y^*)$$

It is easy to see that if a sharing $\acute{\sigma}$ satisfies equation [5], then we must have

$$1 - \frac{(y^d - y^*)}{l(x^*, y^*)} = \acute{\sigma}(x^*, y^*) \equiv \frac{(x^d - x^*)}{l(x^*, y^*)}$$

which implies $\acute{\sigma}(x^*, y^*) = \sigma(x^*, y^*)$. *Q.E.D.*

Appendix 3.1 Definitions as used by WIPO

Appendix 3.1.1 Genetic Resources

At WIPO no fixed definition of Genetic Resources is used. In the most current glossary of key terms related to TK[268], reference is made to definitions in several other documents, such as Convention on Biological Diversity, Decision 391 on Access to Genetic Resources of Andean Community; the FAO Glossary for Fisheries*;* the FAO International Treaty on Plant Genetic Resources for Food and Agriculture the FAO International Code of Conduct for Plant Germplasm Collecting and Transfer; the FAO International Undertaking on Plant Genetic Resources; The European Union Directive on the Legal Protection of Biotechnological Inventions; the United States Code of Federal Regulations;

Appendix 3.1.2 Traditional Knowledge[269]

Under the current negotiations no fixed definition of Expressions of folklore has been chosen yet. There are two options that are currently being used:

Option 1

1.1 For the purposes of this instrument, the term "traditional knowledge" refers to the know-how, skills, innovations, practices, teachings and learning, resulting from intellectual activity and developed within a traditional context.

Option 2

1.1 Traditional knowledge is knowledge that is dynamic and evolving, resulting from intellectual activities which is passed on from generation to generation and includes but is not limited to know-how, skills, innovations, practices, processes and learning and teaching, that subsist in codified, oral or other forms of knowledge systems. Traditional knowledge also includes knowledge that is associated with biodiversity, traditional lifestyles and natural resources.

CRITERIA FOR ELIGIBILITY

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[268] Glossary of key terms related to intellectual property and genetic resources, traditional knowledge and traditional cultural expressions, from December 7, 2011, WIPO/GRTKF/IC/20/INF/13.

[269] In the Glossary of terms (WIPO/GRTKF/IC/20/INF/13.) reference is made to: Article 1 "Subject Matter of Protection" of the Draft Articles on Traditional Knowledge as Prepared at IGC 19 (July 18 to 22, 2011)", as incorporated in document "Matters Concerning the Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore (IGC)" (WO/GA/40/7).

Option 1

1.2 Protection extends to traditional knowledge that is:

(a) the unique product of or is distinctively associated with beneficiaries as defined in Article 2;

(b) collectively generated, shared, preserved and transmitted from generation to generation; and

(c) integral to the cultural identity of beneficiaries as defined in Article 2; / Alternative

(d) not widely known or used outside the community of the beneficiaries as defined in Article 2, for a reasonable period of time with prior informed consent;

or

(d) not widely known or used outside the community of the beneficiaries as defined in Article 2, for a reasonable period of time;

(e) not in the public domain;

(f) not protected by an intellectual property right; and

(g) not the application of principles, rules, skills, know-how, practices, and learning normally and generally well-known.

Option 2

1.2 Protection under this instrument shall extend to traditional knowledge that is generated, preserved and transmitted from generation to generation and identified or associated or linked with the cultural identity of beneficiaries, as defined in Article 2.

The beneficiaries referred to in this definition are defined in Article 2 "Beneficiaries of Protection" of the "Draft Articles on Traditional Knowledge as Prepared at IGC 19 (July 18 to 22, 2011)", as incorporated in document "Matters Concerning the Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore (IGC)" (WO/GA/40/7) which gives 2 options to use as a definition:

Option 1

Beneficiaries of protection of traditional knowledge, as defined in Article 1, are indigenous peoples/communities and local communities.

Option 2

Beneficiaries of protection of traditional knowledge, as defined in Article 1, may include:

(a) indigenous peoples/communities;

(b) local communities;

(c) traditional communities;

(d) families;

(e) nations;

(f) individuals within the categories listed above; and

(g) where traditional knowledge is not specifically attributable or confined to an indigenous peoples or local community, or it is not possible to identify the community that generated it, any national entity determined by domestic law.

Appendix 3.1.3 Traditional Expressions of folklore[270]

Under the current negotiations no fixed definition of Expressions of folklore has been chosen yet. There are two options that are currently being used:

Option 1

1. Traditional cultural expressions are any form of artistic expression, tangible or intangible, in which traditional culture [and knowledge] are embodied including, but not limited to:

(a) phonetic or verbal expressions;

(b) musical or sound expressions;

(c) expressions by action; and

(d) tangible expressions of art.

[270] In the Glossary of terms (WIPO/GRTKF/IC/20/INF/13.) reference is made to Article 1, "Draft Articles on Traditional Cultural Expressions as Prepared at IGC 19 (July18 to 22, 2011)", as incorporated in document "Matters Concerning the Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore (IGC)" (WO/GA/40/7). Article 2 "Beneficiaries" of the "Draft Articles on Traditional Cultural Expressions as Prepared at IGC 19 (July18 to 22, 2011)", as incorporated in document "Matters Concerning the Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore (IGC)" (WO/GA/40/7).

2. Protection extends to traditional cultural expressions that are:

(a) the result of creative intellectual activity;

(b) passed from generation to generation;

(c) distinctive of or the unique product of the cultural and social identity and cultural heritage; and

(d) maintained, used or developed.

by the beneficiaries as set out in Article 2.

3. The terminology used to describe the protected subject matter should be determined at the national, regional, and sub regional levels.

Option 2

1. Traditional cultural expressions are any form of expressions, tangible or intangible, or a combination thereof, which are indicative of traditional culture and knowledge and have been passed on from generation to generation, including, but not limited to:

(a) phonetic or verbal expressions, such as stories, epics, legends, poetry, riddles and other narratives; words, signs, names, and symbols;

(b) musical or sound expressions, such as songs, rhythms, and instrumental music, the sounds which are the expression of rituals;

(c) expressions by action, such as dances, plays, ceremonies, rituals, rituals in sacred places and peregrinations, traditional sports and games, puppet performances, and other performances, whether fixed or unfixed; and

(d) tangible expressions, such as material expressions of art, handicrafts, works of mas, architecture, and tangible spiritual forms, and sacred places.

2. Protection shall extend to any traditional cultural expression that is associated with the cultural and social identity of the beneficiaries as defined in Article 2, and is used, maintained or developed by them as part of their cultural or social identity or heritage in accordance with national law and customary practices.

3. The specific choice of terms to denote the protected subject matter should be determined by national legislation.

The beneficiaries referred to in this definition are defined in Article 2 “Beneficiaries” of the “Draft Articles on Traditional Cultural Expressions as Prepared at IGC 19 (July 18

to 22, 2011)", as incorporated in document "Matters Concerning the Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore (IGC)" (WO/GA/40/7), which defines the term in 3 ways, with the reference to article one referring to the definition of Traditional Expressions of Folklore:

Option 1

Beneficiaries of protection for traditional cultural expressions, as defined in Article 1, are indigenous peoples/communities and local communities, who develop, use, hold and maintain the cultural expressions.

Option 2

Beneficiaries of protection of traditional cultural expressions, as defined in Article 1, are the holders of traditional cultural expressions which may include:

(a) Indigenous communities;

(b) local communities;

(c) traditional communities;

(d) cultural communities;

(e) families;

(f) nations;

(g) individuals within the categories listed above; and

(h) where traditional cultural expressions are not specifically attributable to or confined to an indigenous or local community or it is not possible to identify the community that generated it, any national entity determined by domestic law.

Option 3

Beneficiaries of protection for traditional cultural expressions, as defined under Article 1, are indigenous peoples, local and traditional communities, including small-island states.

Appendix 3.2 Correlation coefficients between the region and the reported legislation on TK and Biological TK.

Figure 20. Correlation coefficients between region and reported.

Significance levels: Values with one asterix are significant at the 10% level, two asterices are significant at the 5% level and three asterices are significant at the 1% level .

	North-America	South-America	Asia	Africa	Europe	Oceania
Biological TK	-0,01	0,28**	-0,06	-0,13*	0,08	-0,05
TK	-0,04	-0,02	0,02	0,06	-0,18**	0,21***

Appendix.3.3 Correlation coefficients between the regions and the content of the reported legislation on TK protection.

Figure 21. Correlation coefficients between region and content of the reported legislation.

OS = ownership placed with state; OIC = ownership placed with indigenous communities; OI = ownership is places with individuals; IS = initiative is left to the state; IIC = initiative is left to indigenous communities; II = initiative is left to individuals; ACI = active commercial interests; DCI = defensive commercial interests; EC = ethical concerns. Significance levels: Values with one asterix are significant at the 10% level, two asterices are significant at the 5% level and three asterices are significant at the 1% level.

	Traditional medicine	Authentic objects	Historical objects	Sacred culture	Folklore	Design	OS
North-America	-0,15	0,27	0,17	0,01	-0,05	0,08	0,04
South-America	0,18	-0,04	-0,20	0,10	0,14	-0,13	-0,30*
Asia	0,47***	-0,22	0,13	0,25	-0,21	0,11	-0,00
Africa	-0,38**	-0,23	-0,22	-0,34**	0,29*	0,04	0,34*
Europe	0,10	-0,06	-0,04	-0,21	-0,05	-0,17	-0,04
Oceania	-0,23	0,39**	0,09	0,18	-0,08	-0,07	-0,25

	OIC	OI	IS	IIC	II	ACI	DCI	EC
North-America	0,23	-0.02	-0,10	0,29*	-0,15	0,13	0,02	0,01
South-America	0,36**	0.07	-0,18	0,42**	0,18	0,21	-0,07	-0,08
Asia	-0,02	0.17	-0,00	-0,09	0,16	0,21	0,09	0,06
Africa	-0,36**	-0.18	0,36**	-0,43***	-0,36**	-0,33*	0,18	-0,11
Europe	-0,21	-0.19	-0,10	-0,18	0,10	0,13	-0,19	-0,01
Oceania	0,18	-0.19	-0,15	0,26	0,15	-0,21	-0,12	0,17

Appendix 3.4 Correlation coefficients within the economic empowerment approach.

Figure 22. Correlation coefficients within the economic empowerment approach.

OS = ownership placed with state; OIC = ownership placed with indigenous communities; OI = ownership is places with individuals; IS = initiative is left to the state; IIC = initiative is left to indigenous communities; II = initiative is left to individuals; ACI = active commercial interests; DCI = defensive commercial interests; EC = ethical concerns. Significance levels: Values with one asterix are significant at the 10% level, two asterices are significant at the 5% level and three asterices are significant at the 1% level.

Economic empowerment	Traditional medicine	OI	OIC	IIC	II
OI	0.06	X			
OIC	0.12	-0.01	X		
IIC	0,20	-0,05	0.73***	X	
II	0,46***	0,36**	0.12***	0,36**	X
ACI	0,53***	0,12	0.35**	0,43**	0,53***

Appendix 3.5 Correlation coefficients within the preservative protection approach.

Figure 23. Correlation coefficients within the preservative protection approach.

OS = ownership placed with state; OIC = ownership placed with indigenous communities; OI = ownership is places with individuals; IS = initiative is left to the state; IIC = initiative is left to indigenous communities; II = initiative is left to individuals; ACI = active commercial interests; DCI = defensive commercial interests; EC = ethical concerns. Significance levels: Values with one asterix are significant at the 10% level, two asterices are significant at the 5% level and three asterices are significant at the 1% level.

Preservative protection	Folklore	Authentic objects	OS	IS
Authentic objects	0,28*	X		
OS	0,19	0,00	X	
IS	0,36**	0,00	0,47***	X
DCI	0,22	0,17	0,22	0,21

Appendix 3.6 Correlation coefficients within the cultural integrity approach.

Figure 24. Correlation coefficients within the cultural integrity approach.

IIC = initiative is left to indigenous communities; OIC = ownership placed with indigenous communities; EC = ethical concerns. Significance levels: Values with one asterix are significant at the 10% level, two asterices are significant at the 5% level and three asterices are significant at the 1% level.

Cultural integrity	Historical objects	Sacred culture	Authentic objects	IIC	OIC
Sacred culture	0,58***	X			
Authentic objects	0.12	-0.16	X		
IIC	0,32*	0,59***	0.11	X	
OIC	0,08	0,34*	0.21	0,73***	X
EC	0.34**	0.36**	0.35**	0.01	0.10

Appendix 3.7 Factor analysis

Appendix 3.7.1 Analysis: does a factor analysis support the theory of the three approaches?

The results from the principal factor analysis, cut off at the first 8 factors, are given in Figure 25 and discussed below.

The first step in analysing the result of a factor analysis, is deciding the number of factors to keep after the initial analysis. To determine how many factor best explain the data, various methods can be used. One is the Kaiser criterion, which calls to only select factors with an Eigenvalue larger than, or equal to 1, this means that one only uses factors that account for a total variance larger than 1. Applying the Kaiser criterion results in the selection of the first 7 factors[271]. The column named "cumulative" shows that together these seven factors can explain 82% of the variance of variables in the database. Another method is to determine a fixed percentage of variance that one would like to have explained by the factors. No consensus on the percentage exists, but examples for 60%,

[271] Although Hair et al. argue that with the number of variables this dataset has (22), the number of factors that will be selected through the Kaiser Criterion is likely to be too few. Hair et al. (1998 p. 103).

70%, 80-85% and 95% are mentioned.[272] Based on this criterion a model with anywhere between 4 and 10 factors[273] would be selected. Given the low number of observations in the dataset an explanation of 60-70% would already be quite an achievement. It is also acceptable practice to base the selection of factors on how much of the factors can be explained by the theory.[274] Any combination of these criterions can be used. A combined application of these criterions to the results in Figure 25 would lead us to select a model with 4 to 6 factors, depending on how well the factor loadings can be explained by the theory. A model with 4 factors would be able to explain 60% of the variance, and a model with 6 factors would be able to explain 75% of the variance.

Figure 25. Principal factor analysis – regions included

factor analysis/correlation		
Method:		principal factors
number of parameters	=	231
Number of observation	=	35
Retained factors	=	16

Factor	Eigenvalue	Cumulative
factor 1	4,5568	0,2496
factor 2	2,7046	0,3978
factor 3	2,1630	0,5162
factor 4	1,5336	0,6003
factor 5	1,4615	0,6803
factor 6	1,2839	0,7506
factor 7	1,2140	0,8171
factor 8	0,9571	0,8696

The next step is to look at the factor loadings, The factor loadings of the first 8 factors are given below in Figure 26.

[272] Habing (2003).
[273] 4 factors for 60%, 6 for 70%, 7 for 80%, 7 for 85% and 10 for 95%.
[274] Habing (2003).

Figure 26. Factor loadings per factor – regions included

Bold: economic empowerment, italics: preservative protection, underlined: cultural integrity

factor loadings and unique variances	>0,3							
variable	factor 1	factor 2	factor 3	factor 4	factor 5	factor 6	factor 7	factor 8
North America		**0,31**			0,40	*-0,43*	-0,48	-0,39
South America	***0,31***		0,37			*0,55*	-0,36	0,31
Asia		**-0,35**	-0,56	0,40				
Africa	***-0,72***							
Europe			-0,36	-0,37	0,45			
Oceania		**0,53**					0,69	
Traditional medicine	**0,51**	**-0,65**						
Authentic objects		0,53			0,48			
Historical objects	**0,33**	0,43		0,42				0,42
Sacred culture	**0,60**			0,39	-0,42			
Folklore	*-0,52*					*0,44*		
Design				0,44				
Ownership State	*-0,57*			0,35				
Ownership Communities	**0,67**		0,41					
Ownership Individuals			-0,31		0,44	*0,45*		
Initiative State	*-0,67*					*0,32*		
Initiative Communities	**0,78**		0,41					
Initiative Individuals	**0,59**						0,32	0,35
Active commercial interests	**0,59**	**-0,45**						
Defensive commercial interests		**-0,35**	0,42	0,43	0,35			
Ethical concerns		0,63						
GDP	***0,43***	**0,48**	-0,40					

Now to determine which factors should be included, Stevens (2002) gives some guidelines for the selection of factors, based on a combination of the factor loadings and the number of observations. He states that:

A factor is reliable if it has:

- *3 or more variables with loadings of 0.8 and any n*
- *4 or more variables with loadings of 0.6 and any n*
- *10 or more variables with loadings of 0.4 and n≥150*
- *Factors with only a few loadings require n≥300*

The last two criterions can be discarded as the dataset has an n<150. None of the factors pass the second criterion, and only factor 1 passes the second criterion. This leaves us only with the method of finding support for the original theory of the three approaches in the factor loadings.

Figure 26 shows the factor loadings of the first 8 factors. Only the factor loadings with an absolute value of ≥ 0.3 are shown. Note that the value of these factor loadings are rather low, as one would prefer to have factors with loadings of at least 0.6. The factor loadings for factor 9 and higher had no more than one factor loadings with a value higher than 0.3, and are omitted from this overview.

The factor loadings in bold belong to the economic empowerment approach, factor loadings in italics signify preservative protection, and a line underneath the loadings points out support for the cultural integrity approach. The remainder of the factor loadings provide information on the region and income specific nuances that can be given to the legislative choices.

Factor 1 shows positive support for the economic empowerment approach, the factor loadings that support this pillar are printed in bold. It shows that countries that would have a high value for the underlying factor 1 are inclined to have protection for traditional medicine, place ownership with indigenous communities, to leave the initiative to apply for the protection up to individuals and/or indigenous communities, and the aim of the legislation is to protect active commercial interests. The positive factor loadings for South America and GDP show that if a country has a high value for factor 1, it is more likely to have a high GDP or to be South American. Or in other words, South American countries and countries with a relative higher GDP are inclined to follow the economic empowerments approach in their legislation. The negative factor loading for Africa means that African countries are less likely to follow the economic empowerment approach in their legislation.

The positive factor loadings for the variables historical objects and sacred culture must lead to the consideration to include these within the economic empowerment approach. From a policy perspective this can make sense if the historical objects and sacred culture are forms of TK which have potential economic value to its owners. As discussed before if the aim of the protection lies within the economic empowerment approach, and the indigenous communities are the economically weaker groups in society, this type of legislation creates a possibility for these groups to monetize on the value of their TK. This signals a policy choice which values the economic value and commercial potential of these

forms of TK over the cultural value. The factor loadings show that the wealthier South American countries are most likely to include these forms of TK in their legislation when they follow the economic empowerment approach.

Moving on to factor 2, the factor loadings in bold also support the economic empowerment approach. The negative value of these factor loadings show that the lower a country's value for factor 2, the more likely it is to have legislation within the economic empowerment approach. Again this concerns legislation to protect traditional medicine, with an active commercial interest at heart, The nuance that factor 2 brings to this approach is that mainly those Asian countries with a relatively low GDP, are likely to also protect defensive commercial interests of traditional medicine. This is shown by the negative factor loading for Asia, and the positive factor loading for GDP. The positive loadings for North America and Oceania show that countries from these regions are less likely to include the protection of traditional medicine in their legislation. Together these two factors support the economic empowerment approach.

Moving back to factor 1 again, the factor loadings printed in italics support the preservative protection approach. Countries that have a very low value for factor 1 are likely to have legislation following preservative protection. It shows that the protection of folklore is mostly done by placing both the ownership and the initiative with the state. It also shows that African countries and countries with a low GDP are most likely to follow this approach. Factor 6 also shows loading within the preservative protection approach. It shows that South American countries following this approach still place the initiative with the state, but they are more likely to place the ownership with individuals. North American countries are very unlikely to do this, when they make legislation within the preservative protection approach.

Moving back to factor 2, and focussing on the factor loadings that are underlined, we see support for the cultural integrity approach. Countries with high values for factor 2 are expected to protect authentic and historical objects, and to do so with ethical concerns in mind. These are more likely to be countries with a high GDP, and countries from Oceania or North America. Asian countries with low GDPs are less likely to follow this approach.

The fact that factor one shows support for both economic empowerment and preservative protection shows that countries' preferences for the two approaches are not independent, on the contrary, they are negatively correlated. A country with a high value for factor 1 (such as Australia, Peru and the Philipines), is likely to follow the economic empowerment approach and very unlikely to follow the preservative protection approach.

A country with a very low negative value for factor 1 (such as Cote d'Ivoire, Malawi and Tanzania) is very likely to follow the preservative protection approach, but it could still also have legislation within the economic empowerment approach, through factor 2. A country's value for factor 2 is independent of its value for factor 1. If a country has a high value for factor 2 (such as Australia, the USA and Vanuatu) it is likely to follow the cultural integrity approach in its legislation. If a country has a negative value for factor 2 (such as China, the Kyrgyz Republic and Italy) it is likely to have legislation within the economic empowerment approach and unlikely to follow the cultural integrity approach. Figure 27 and Figure 28 show an overview of these results.

Figure 27. Link between factor scorings and approach taken

Most likely approach		
	A country's rating for factors	
	High	**Low**
Factor 1	Economic empowerment	Preservative protection
Factor 2	Cultural integrity	Economic empowerment

Figure 28. Link between factor scorings, region and wealth

	Expected scoring	
	High	**Low**
Factor 1	Rich South American	Poor African
Factor 2	Rich North American and rich Oceanian	Poor Asian

The rest of the factors provide nuances and regional preferences, additional to the three approaches. For example factor 3 shows that, everything else being equal, Rich Asian and European countries have a stronger preference than other countries to place ownership of any form of TK with individuals, over indigenous communities, to not place initiative with indigenous communities, and to protect defensive commercial interests. And poor South American countries have opposite preferences. Factor 7 shows that Oceanian countries have a stronger preferences than American countries to place initiative with individuals. Et cetera.

Having done this analysis, it is clear that the factor analysis gives support for the theory of the three approaches. H1 cannot be rejected based on these results. The next question is now how much the theory of the three approaches actually captures.

Appendix 3.7.2. How much of the legislative choices is explained by the theory of the three approaches?

To answer the second question; how much of the legislative choices can be explained by this theory, some caution is needed. Due to the high number of variables (22) relative to the low number of observations (35 countries), it is almost impossible to capture a large part of the variation with the theory of the three approaches. Factor 1 and 2 in the factor analysis with the regions included, as shown above, together explain 40% of the total variation in the data (the values for the cumulative explanatory proportion given in Figure 25). Allowing factor 6 to also be taken into account increases this number to 47%

To remedy this, some simplification of variables is needed. Dropping the regional variables, taking the natural logarithm of a country's GDP, produces similar patterns in the factor loadings, but increases the explanatory power of factor 1 and 2 to 58% (see figure 29).

Figure 29. Principal factor analysis

Regions excluded

factor analysis/correlation		
Method:		principal factors
number of parameters	=	115
Number of observation	=	35
Retained factors	=	10

factor	Eigenvalue	Cumulative
factor 1	3,8085	0,3644
factor 2	2,2078	0,5757
factor 3	1,5247	0,7215
factor 4	1,0877	0,8256
factor 5	0,9820	0,9196

factor loadings and unique variances, with values ≥0.4

variable	factor 1	factor 2	factor 3	factor 4	
Traditional medicine	0,516	-0,421	-0,410		
Authentic objects			0,585		
Historical objects		0,556		0,411	
Sacred culture	0,565	0,451		0,422	
Folklore	-0,518		0,430		
Design					
Ownership State	-0,556			0,441	
Ownership Communities	0,663		0,412		
Ownership Individuals					
Initiative State	-0,723				
Initiative Communities	0,778				
Initiative Individuals	0,600				
Active commercial interests	0,631				
Defensive commercial interests		-0,501	0,543		
Ethical concerns		0,751			
ln(GDP)	0,351	0,476			

Figure 30. Principal factor analysis

Ownership and initiative combined, no regions included. Including factor loadings ≥0.38, and the factor loading for folklore in factor 3.

factor loadings and unique variances

variable	factor 1	factor 2	factor 3
Traditional medicine	0,558	-0,473	
Authentic objects			0,579
Historical objects		0,560	
Sacred culture	0,633	0.386	
Folklore	-0,537		0,374
Design			0,402
Rightholder state	-0,670		0,425
Rightholder communities	0,682		
Rightholder individuals	0,422		
Active commercial interests	0,580	-0,434	
Defensive commercial interests		-0,515	0,528
Ethical concerns		0,701	
ln(GDP)	0,414	0,444	

factor analysis/correlation

Method:		principal factors
number of parameters	=	76
Number of observation	=	35
Retained factors	=	8

factor	Eigenvalue	Cumulative
factor 1	2,8460	0,3733
factor 2	2,0384	0,6406
factor 3	1,3099	0,8125
factor 4	0,8631	0,9257

A next step in simplifying the variables relates to the variables for ownership and initiative. A strong positive correlation exists[275] between a legislator's choice to place the ownership with a party, and to place the initiative for protection with the same party. This is resolved by creating a new variable, named 'rightholder state', with a value of 1 if a country has legislation placing either ownership or initiative with the state, and a value of 0

[275] With a significance level of 1% for each coupling: ownership state – initiative state, ownership indigenous communities – initiative indigenous communities, ownership individuals – initiative individuals, see appendices 3.4 up to 3.6.

otherwise. In a similar way the two variables ‘rightholder communities’, and ‘rightholder individuals’ are created. Decreasing the number of variables to 13. The results of the factor analysis on these data are shown in

Figure 30. They show a factor 1 and 2 similar to those of the previous factor analysis. Factor 3 is the remaining factor supporting the preservative protection approach, showing that those countries that choose to include authentic objects and design with folklore in this approach, appoint the state as a rightholder, and opt for the protection of defensive commercial interests. Note that factor 3 seems to be a combination of the factors 4, 5 and 6 in the initial factor analysis that included the regions. This means that once the differentiating characteristic of the region is removed, the small differences in legislative choices made by countries following this approach are mainly correlated to the region in which the countries are situated. Note that the factor loading for folklore in factor 3, at 0.374 is lower than 0.4, but due to its explanatory value it is included here. A country with a high scoring is likely to follow the preservative protection approach.

Together these three factors explain over 81% of the variation in the data. This shows that the theory of the three approaches can explain up to 81% of the legislative choices made by countries protecting their TK. A country's preferences for either of the three approaches can be based on its scoring in factors 1, 2 and 3, as shown in Figure 31.

Figure 31. Link between factor scorings and approach taken

Most likely approach		
	A country's rating for factors	
	High	**Low**
Factor 1	Economic empowerment	Preservative protection
Factor 2	Cultural integrity	Economic empowerment
Factor 3	Preservative protection	-

Combining these results shows that the factor analysis supports the theory of the three approaches as presented in figure 32. Statements in between brackets are only supported when the dataset is simplified, this is due to the relative small number of observations.

Figure 32. Three approaches as supported by the factor analysis.

	Economic empowerment	**Preservative protection**	**Cultural Integrity**
Type of TK	Traditional medicine (and sacred culture for South American countries)	Folklore (and authentic objects and design)	Sacred Culture, authentic objects and historical objects
Interest protected	Active commercial interests (and defensive commercial interests for Asian countries)	Defensive commercial interests	Ethical concerns
Ownership	Indigenous communities	State (indigenous communities and individuals)	-
Initiative	Indigenous communities and individuals	State	-

The individual scorings on these factors, tell us show us how strong countries' legislation follows the approaches. The country that scores highest on factor 1 is the Kyrgyz Republic, with a scoring of 2.22. A scoring of -1.42 in factor 2 for the Kyrgyz republic shows a strong preference for the economic empowerment approach. Combined with a scoring of 0.17, the Kyrgyz Republic shows no interest in either the preservative protection approach or the cultural integrity approach.

Malawi is the lowest scoring country on factor 1, with a value of -1.03. Combined with a scoring of -0.6 in factor 2 and 0.12 in factor 3, Malawi shows a strong preference for the preservative protection approach, and a mild interest in the economic empowerment approach.

The highest scoring country for factor 2 is Japan, with a scoring of 1.42, showing strong preferences for the cultural integrity approach. A scoring of -0.01 in factor 1, and -1.19 in factor 3 show that Japan have no other interests than that approach.

The country with the lowest score for factor 2 is Thailand, with -1.53, showing a preference for economic empowerment. A scoring of 0.18 for factor 1 and -1.43 for factor 3 shows that Thailand has no other interests than economic empowerment.

Scoring relatively high in both factor 1 and 2 is Australia, with 1.84 for factor 1 and 1.38 for factor 2. This means that Australia's legislation combines both a lot of elements from the economic empowerment approach and a lot of elements from the cultural integrity approach.

Panama, with a scoring of 2.06, has the highest scoring for factor 3. A scoring of 1.24 for factor 1 and -0.58 for factor 2 show that Panama has preferences for both economic empowerment and preservative protection.

Italy has the lowest score for factor 3, with -1.96. A scoring of 1.37 for factor 1 and -1.37 for factor 2 show that Italy has legislation in place following the economic empowerment approach.

Figure 33 shows the scorings of each country for factor 1 plotted against the scorings for factor 2.

Figure 33. Factor scorings for countries for factor 1 and 2.

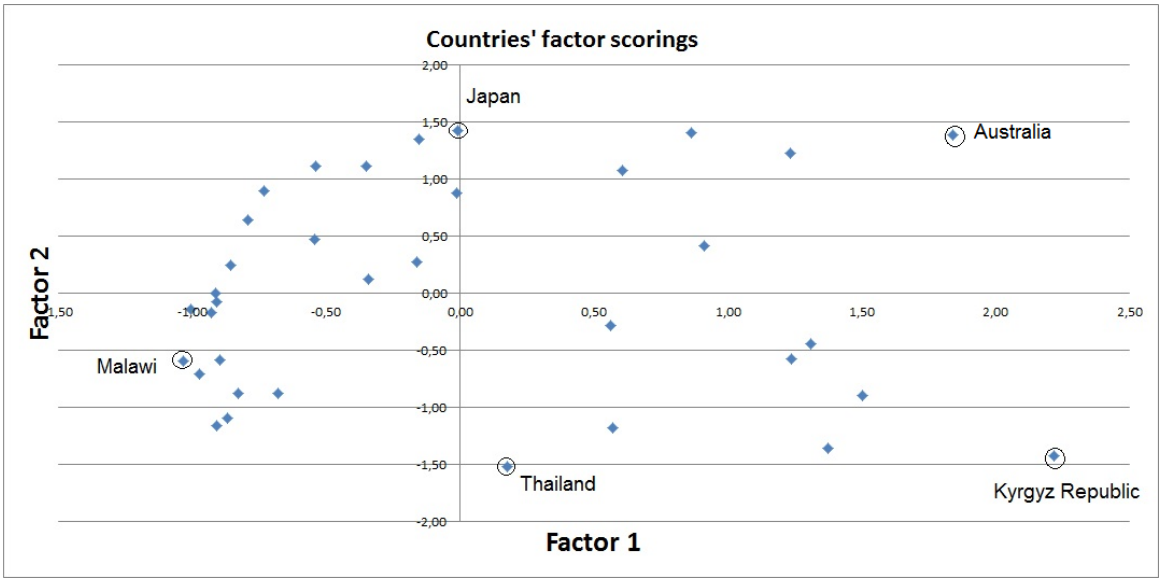
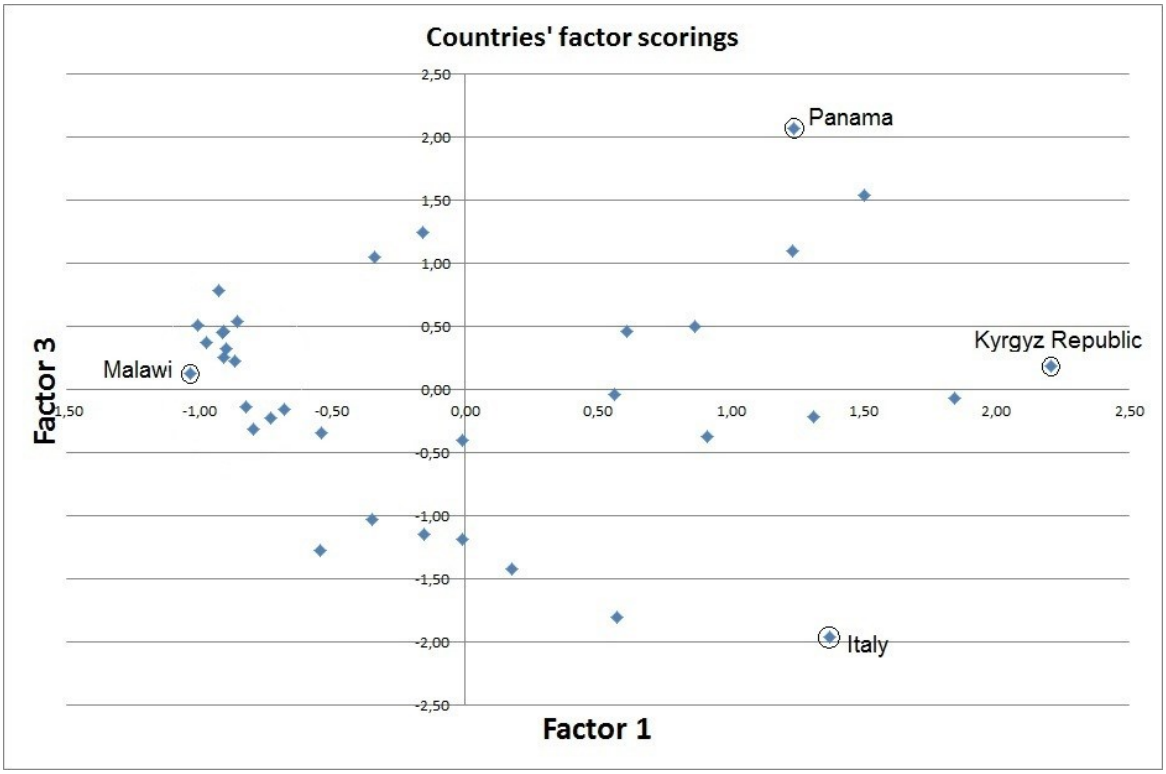


Figure 34 shows the scorings of each country for factor 1 plotted against the scorings for factor 3. The cloud of points that is grouped in the top left quadrant of the scatterplot, are countries that have a positive scoring for factor 3 and a negative scoring for factor 1. These countries are the most inclined to have legislation following the preservative protection approach. Of these 12 countries, 7 are African, 2 are Oceanian, 2 Asian, and the last one is Azerbaijan, which is situated on the border between Europe and Asia. The strong representation of African countries is in line with the conclusion that African countries show a stronger preference for preservative protection than other countries.

Figure 34. Factor scorings for countries for factor 1 and 3.



Appendix 5.1 Proof of the Generalized Jury Theorem

Before proceeding, we show that the if the variance of the jury decision approaches 0, then the probability that the jury decision equals the correct decision approaches 1. That is, when the variance of the distribution goes to 0, the probability that the jury decision differs less than any small $\delta > 0$ from the correct decision goes to 1. We will prove this for any sequence of random variables whose variance goes to 0.

Lemma. $\lim_{m\to\infty} \mathrm{E}(X_m - x^*)^2 = 0$ implies that for all $\delta > 0$, we have

$$\lim_{m\to\infty} \Pr(|X_m - x^*| \leq \delta) = 1$$

Proof. Let X_m be a sequence of random variables with $\lim_{m\to\infty} \mathrm{E}(X_m - x^*)^2 = 0$. Note that this means that for all $\varepsilon > 0$ there is an $M \in \mathbb{N}$ so that if $m > M$ then $\mathrm{E}(X_m - x^*)^2 < \varepsilon$. Now we want to prove that for sufficiently small ε the chance that $|X_m - x^*| \leq \delta$ has a minimum. We will do that by defining another random variable Y with $\mathrm{E}(Y - x^*)^2 = \varepsilon$ and the lowest possible chance in $(x^* - \delta, x^* + \delta)$. We take $\varepsilon \leq \delta^2$ and define the random variable Y as follows:

$$\Pr(\mathrm{Y} = y) = \begin{cases} \frac{\epsilon}{\delta^2} \text{ if } y = x^* - \delta \\ 1 - \frac{\epsilon}{\delta^2} \text{ if } y = x^* \\ 0 \text{ if } else \end{cases}$$

Then $\Pr\big(Y \in (x^* - \delta, x^* + \delta)\big) = \Pr(Y = x^*) = 1 - \frac{\epsilon}{\delta^2}$. Because $\varepsilon \leq \delta^2$, this is a well-defined probability.

Claim. We have:

1. $\mathrm{E}(Y - x^*)^2 = \varepsilon$;
2. $\Pr\big(Y \in (x^* - \delta, x^* + \delta)\big)$ is minimal.

Proof. Concerning the first part of the claim, we have:

$$\mathrm{E}(Y - x^*)^2 = (-\delta)^2 \alpha \frac{\epsilon}{\delta^2} + \delta^2 (1 - \alpha) \frac{\epsilon}{\delta^2} + 0^2 \left(1 - \frac{\epsilon}{\delta^2}\right) = \epsilon$$

Concerning the second part of the claim, assume Z is a random variable with $\mathrm{E}(Z - x^*)^2 = \varepsilon$ and

$$\Pr\big(Z \in (x^* - \delta, x^* + \delta)\big) < \Pr\big(Y \in (x^* - \delta, x^* + \delta)\big) = 1 - \frac{\epsilon}{\delta^2}$$

then $\Pr(Z \in (-\infty, x^* - \delta] \cup [x^* - \delta, \infty)) = \beta > \frac{\epsilon}{\delta^2}$, so that

$$\mathrm{E}(Z - x^*)^2 \geq 0^2(1 - \beta) + \delta^2\beta > \varepsilon$$

because having chance in $(x^* - \delta, x^* + \delta)$ but not at x^*, or having chance in $(-\infty, x^* - \delta] \cup [x^* - \delta, \infty)$ but not at $x^* \pm \delta$ gives a higher expected quadratic distance to x^*. So this contradicts the assumption. Thus, there is no random variable $Z \neq Y$, with $\mathrm{E}(Z - x^*)^2 = \varepsilon$ and

$$\Pr\big(Z \in (x^* - \delta, x^* + \delta)\big) < \Pr\big(Y \in (x^* - \delta, x^* + \delta)\big)$$

which proves the claim.

Returning to the proof of the Lemma, the Claim implies that

$$\Pr(X_m \in [x^* - \delta, x^* + \delta]) \geq \Pr\big(X_m \in (x^* - \delta, x^* + \delta)\big)$$
$$\geq \Pr\big(Y \in (x^* - \delta, x^* + \delta)\big)$$

Or, more specifically

$$\Pr(X_m \in [x^* - \delta, x^* + \delta]) \geq 1 - \frac{\varepsilon}{\delta^2}$$

We can now prove that $\lim_{m\to\infty} \Pr(X_m \in [x^* - \delta, x^* + \delta]) = 1$. For any $\varepsilon_2 > 0$, use $\varepsilon = \delta^2 \min\ \{\varepsilon_2, 1\}$ and take $M' \in \mathbb{N}$ so that $m > M'$, then $\mathrm{E}(X_m - x^*)^2 < \varepsilon$.

Then the claim implies that

$$|\Pr(X_m \in [x^* - \delta, x^* + \delta]) - 1| \leq 1 - \left(1 - \frac{\delta^2\varepsilon_2}{\delta^2}\right) = \varepsilon_2$$

(or 1 if $\varepsilon_2 > 1$). Concluding, if $\lim_{n\to\infty} \mathrm{E}(X_m - x^*)^2 = 0$, then for all $\delta > 0$

$$\lim_{m\to\infty} \Pr(X_m \in [x^* - \delta, x^* + \delta]) = 1$$

Which proves the lemma.

Proof of the Generalized Jury Theorem. If $\hat{\hat{X}}_n$ is an unbiased estimator satisfying the Cramér-Rao lower bound, then $Var\big(\hat{X}_n\big) = \frac{1}{nI(\theta)}$. Assume further that the Fisher information $I(\theta)$ increases in a.

1. Consider $\bar{X}_n \equiv \frac{1}{n}\sum_{i=1}^{n} X_i$ and note that $\bar{X}_n$ is an unbiased estimator[276], but not necessarily a minimum-variance estimator; thus

[276] This is because $E(\bar{X}_n) = E(X_i) = x^*$.

$$Var(\hat{X}_n) \leq Var(\bar{X}_n) = \frac{1}{n^2}\sum_{i=1}^{n} Var(X_i) = \frac{Var(X_i)}{n} < Var(X_i)$$

It follows that $A = \frac{1}{1+Var(\hat{X}_n)} > \frac{1}{1+Var(X_i)} = a$.

2. Write $Var(X_i) = \frac{1-a}{a}$ and note that $\frac{\partial Var(X_i)}{\partial a} = -\frac{1}{a^2} < 0$ and that $\frac{\partial I(\theta)}{\partial a} = \frac{\partial I(\theta)}{\partial Var(X_i)}\frac{\partial Var(X_i)}{\partial a}$. Therefore $I(\theta)$increases in a if and only if $I(\theta)$decreases in $Var(X_i)$. It is not generally true that if $I(\theta)$decreases in $Var(X_i)$; thus the theorem holds only if this is the case. Assuming $I(\theta)$decreases in $Var(X_i)$:

$$\frac{\partial Var(\hat{X}_n)}{\partial Var(X_i)} = \frac{\partial}{\partial Var(X_i)}\left(\frac{1}{nI(\theta)}\right)$$
$$= \frac{1}{n}\frac{\partial}{\partial Var(X_i)}\left(\frac{1}{I(\theta)}\right)$$
$$= \frac{1}{n}\left(-\frac{1}{I(\theta)^2}\right)\frac{\partial I(\theta)}{\partial Var(X_i)}$$

Since $\frac{1}{n} > 0$, $\left(-\frac{1}{I(\theta)^2}\right) < 0$ and $\frac{\partial I(\theta)}{\partial Var(X_i)} < 0$ by assumption, the product is greater than 0, thus $\frac{\partial Var(\hat{X}_n)}{\partial Var(X_i)} > 0$. Using the chain rule and making the appropriate substitutions, we have

$$\frac{\partial Var(\hat{X}_n)}{\partial Var(X_i)} = \frac{\partial\left(\frac{1-A}{A}\right)}{\partial\left(\frac{1-a}{a}\right)} = \frac{\partial\left(\frac{1-A}{A}\right)}{\partial A}\frac{\partial A}{\partial a}\frac{\partial a}{\partial\left(\frac{1-a}{a}\right)} = \left(-\frac{1}{A^2}\right)\frac{\partial A}{\partial a}(-a^2)$$

Which yields $\frac{\partial A}{\partial a} = \frac{A^2}{a^2}\frac{\partial Var(\hat{X}_n)}{\partial Var(X_i)} > 0$.

3. We have

$$\frac{\partial A}{\partial n} = \frac{\partial A}{\partial Var(\hat{X}_n)}\frac{\partial Var(\hat{X}_n)}{\partial n}$$
$$= -\left(\frac{1}{1+Var(X_i)}\right)\left(-\frac{1}{n^2 I(\theta)}\right) > 0$$

4. $\lim_{n\to\infty}\left[Var(\hat{X}_n)\right] = \lim_{n\to\infty}\frac{1}{nI(\theta)} = 0$. By the Lemma, the probability that the jury takes the correct decision approaches 1.

Appendix 5.2 A jury decision modelled by means of a Bernoulli *(p)* distribution is regular

Proof. Let $X_1, \dots, X_n \sim$Bernoulli*(p)*. First, we identify the estimator. Note that, for all $i \in \{1, \dots n\}$, $Var(X_i) = p(1-p)$. The Fisher information is,

$$I(p) = E\left[\left(\frac{\partial}{\partial p}\left(log(p^{X_i}(1-p)^{1-X_i})\right)\right)^2\right]$$

$$= E\left[\left(\frac{\partial}{\partial p}(X_i log(p) + (1-X_i)\log(1-p))\right)^2\right]$$

$$= E\left[\left(\frac{X_i}{p} - \frac{1-X_i}{1-p}\right)^2\right] = \frac{E[(X_i-p)^2]}{[p(1-p)]^2}$$

Using $E(X_1 - p)^2 = Var(X_i)$ gives

$$I(p) = \left(\frac{1}{p(1-p)}\right)^2 Var(X_1) = \frac{1}{p(1-p)}$$

Thus the Cramér-Rao lower bound is $\frac{1}{nI(p)} = \frac{p(1-p)}{n}$. Now take the mean of the signals $\bar{X}_n = \frac{1}{n}\sum_{i=1}^{n} X_i$ and note that $Var(\bar{X}_n) = \frac{Var(X_i)}{n} = \frac{p(1-p)}{n} = \frac{1}{nI(p)}$

Thus $\bar{X}_n$ attains the Cramér-Rao lower bound, Second, note that $I(p) = \frac{1}{Var(X_i)}$ decreases in $Var(X_i)$.

Appendix 5.3 A Jury decision modelled by means of a $N(\mu, \sigma^2)$ distribution is regular

Proof. Let $X_1, \dots, X_n \sim N(\mu, \sigma^2)$. Note that

$$I(\mu) = E\left[\left(\frac{\partial}{\partial \mu} log\left[\frac{1}{\sqrt{2\pi^2}} e^{-\frac{(X_i-\mu)^2}{2\sigma^2}}\right]\right)^2\right]$$

$$= E\left[\left(\frac{(X_i-\mu)}{\sigma^2}\right)^2\right] = \frac{1}{\sigma^4} E(X_i-\mu)^2 = \frac{1}{\sigma^2}$$

Thus the Cramér-Rao lower bound. Next, note that $I(\mu) = \frac{1}{Var(X_i)}$ decreases in $Var(X_i)$.

Appendix 5.4 Optimal weights with heterogeneous jurors

To see that $\check{X}_n$ is the UMVU estimator in a setting where jurors have different accuracy levels, let $Z_i \equiv \frac{n}{\sum_{i=1}^{n}\frac{1}{\sigma_i}}\left(\frac{X_i-\mu}{\sigma_i}\right)+\mu$ and note that

$$X_i \sim N(\mu, \sigma_i^2) \Rightarrow \frac{X_i-\mu}{\sigma_i} \sim N(0,1)$$

$$\Rightarrow \frac{n}{\sum_{i=1}^{n}\frac{1}{\sigma_i}}\left(\frac{X_i-\mu}{\sigma_i}\right) \sim N\left(0, \frac{n^2}{\left(\sum_{i=1}^{n}\frac{1}{\sigma_i}\right)^2}\right)$$

$$\Rightarrow \frac{n}{\sum_{i=1}^{n}\frac{1}{\sigma_i}}\frac{X_i-\mu}{\sigma_i}+\mu \sim N\left(\mu, \frac{n^2}{\left(\sum_{i=1}^{n}\frac{1}{\sigma_i}\right)^2}\right)$$

Thus, $Z_i \sim N\left(\mu, \frac{n^2}{\left(\sum_{i=1}^{n}\frac{1}{\sigma_i}\right)^2}\right)$. Since $Z_1, \ldots, Z_n$ are i.i.d. normally distributed, the UMVU estimator for μ is $\check{X}_n \equiv \frac{1}{n}\sum_{i=1}^{n} Z_i$. Substituting Z_i, we have

$$\check{X}_n = \frac{1}{n}\sum_{i=1}^{n}\left(\frac{n}{\sum_{i=1}^{n}\frac{1}{\sigma_i}}\left(\frac{X_i-\mu}{\sigma_i}\right)+\mu\right)$$

$$= \sum_{i=1}^{n}\frac{n}{n\sum_{i=1}^{n}\frac{1}{\sigma_i}}\left(\frac{X_i-\mu}{\sigma_i}\right)+\frac{n}{n}\mu$$

$$= \sum_{i=1}^{n}\frac{1}{\sum_{i=1}^{n}\frac{1}{\sigma_i}}\left(\frac{X_i-\mu}{\sigma_i}\right)+\mu$$

$$= \frac{1}{\sum_{i=1}^{n}\frac{1}{\sigma_i}}\sum_{i=1}^{n}\frac{X_i}{\sigma_i}-\frac{1}{\sum_{i=1}^{n}\frac{1}{\sigma_i}}\sum_{i=1}^{n}\frac{1}{\sigma_i}\mu+\mu$$

$$= \frac{1}{\sum_{i=1}^{n}\frac{1}{\sigma_i}}\sum_{i=1}^{n}\frac{X_i}{\sigma_i}-\frac{1\sum_{i=1}^{n}\frac{1}{\sigma_i}}{\sum_{i=1}^{n}\frac{1}{\sigma_i}}\mu+\mu$$

$$= \frac{1}{\sum_{i=1}^{n}\frac{1}{\sigma_i}}\sum_{i=1}^{n}\frac{X_i}{\sigma_i}-\mu+\mu$$

$$= \frac{1}{\sum_{i=1}^{n} \frac{1}{\sigma_i}} \sum_{i=1}^{n} \frac{X_i}{\sigma_i}$$

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Domestic legislation and regulations

Algeria	• *Copyrights and Neighboring Rights Act, 2003*
Argentina	• *Decreto No 474 de Biodiversidad (Provincia de Misiones)* • *Ley no 3337 sobre la Conservación y Aprovechamiento Sostenible de la Diversidad Biológica y sus Componentes (Provincia de Misiones)* • *Ley No. 2503 Acceso a los Recursos Genéticos y Bioquímicos (Provincia de Neuquén)* • *Resolución 91/03 Estrategia Nacional sobre Diversidad Biológica* • *Resolución no 22/2006 del Instituto Nacional de Semillas (INASE)*
Australia	• *Aboriginal and Torres Strait Islander Protection Act, 1984* • *Environment Protection and Biodiversity Conservation Act 1999* • *Environment Protection and Biodiversity Conservation Amendment Regulations 2005 (No.2)* • *Environment Protection and Biodiversity Conservation Regulations 2000* • *Northern Territory of Australia Biological Resources Act 2006* • *Protection of Moveable Cultural Heritage Act, 1986*
Azerbaijan	• *The Law of the Republic of Azerbaijan "On Legal Protection of Azerbaijani Expressions of Folklore", 2006*
Belgium	• *Belgian Patent Act 1984 amended on April 28, 2005*
Bhutan	• *Biodiversity Act of Bhutan, 2003*
Bolivia	• *Constitucion Politica de Bolivia, 2009* • *Leyes de Derecho de Autor, 1992* • *Constitucion Politica de la Republica de Bolivia, 1967* • *Supreme Decree NO.24676, Regulation of Decision 391 on the Common Regime for Access to Genetic Resources, 1997*
Brazil	• *Provisional Measure No. 2,186-16 of 2001 Regulating Access to the Genetic Heritage* • *Decree Nº 5.459 of 2005 Regulating Art. 30 of the Provisional Measures Nº 2.186-16*
Bulgaria	• *Biological Diversity Act 2002*
Burkina Faso	• *Loi portant protection de la Propriété Littéraire et Artistique, 1999*
Cameroon	• *Loi No. 96/12 Portant Loi-Cadre Relative à la Gestion de l'Environnement*
Canada	• *Guiding Principles and Features of ABS Policies in Canada* • *Copyright Act, R.S., Copyright Board of Canada. 2005.*
Chile	• *Leyes de Derecho de Autor, 1970* • *National Biodiversity Strategy of the Republic of Chile* • *Plan de Acción de País para la Implementación de la Estrategia Nacional de Biodiversidad 2004-2015*
China	• *Patent Law of 2008* • *Patent Law of 2000* • *Regulation on the Protection of New Varieties of Plants 1997* • *Regulations on Protection of Traditional Chinese Medicines, 1992*

Colombia	• *Leyes de Derecho de Autor, 1982* • *Constitución Política Nacional* • *Decreto 309 de 25 de febrero de 2000 "Por el cual se reglamenta la investigación científica sobre diversidad biológica"* • *Decreto No. 730 del 14 de marzo de 1997 por el cual se determina la Autoridad Nacional Competente en materia de acceso a los recursos genéticos*
Costa Rica	• *Biodiversity Law No. 7788* • *Executive Decree No. 31514, General Rules for the Access of Genetic and Biochemical Elements and Resources of Biodiversity (2003)*
Cote d'Ivoire	• *Law on the Protection of Intellectual Works and the Rights of Authors, Performers and Phonogram and Videogram Producers, 1996*
Denmark	• *Act 412 (31/5/2000) amending the Patent Act (consolidated Patent Act 926 22/9 2000)*
Ecuador	• *Constitution of Ecuador, 2008* • *Law on Intellectual Property of Ecuador, 1998*
Egypt	• *Law on the Protection of Intellectual Property Rights (Law No. 82)*
Ethiopia	• *Access to Genetic Resources and Community Knowledge and Community Rights Proclamation 2006*
European Union	• *European Directive 2004/24 as Regards Traditional Herbal Medicinal Products* • *European Directive 2006/509 on Traditional Specialities Guaranteed* • *Directive 98/44/EC on the Legal Protection of Biotechnological Inventions*
Germany	• *Patent Law of 2009*
Ghana	• *Copyright Act, 2005*
India	• *Indian Biodiversity Act of 2002* • *Biological Diversity Act of 2004* • *The patents act 1970, 39 of 1970, 19-9-1970, As amended by Patents Act, 2005 15 of 2005, 4-4-2005.* • *Drugs and Cosmetics act 1940, 23 of 1940, 10-4-1940, As amended by the Drugs (Amendment) Act, 1955, the Drugs (Amendment) Act, 1960, the Drugs (Amendment) Act, 1964, the Drugs (Amendment) Act, 1972, the Drugs (Amendment) Act, 1982, the Drugs (Amendment) Act, 1986, and the Drugs (Amendment) Act, 1995.*
Indonesia	• *Copyright Law, 2002*
Italy	• *Attuazione della direttiva 92/73/CEE in materia di medicinali omeopatici* • *Regional Act No.11 of 2002 on Protection of Autochthonous Genetic Resources of Agricultural Interest*
Japan	• *Law for the Protection of Cultural Properties, 1950*
Kenya	• *Conservation of Biological Diversity and Resources, Access to Genetic Resources and Benefit Sharing Regulations 2006 of the*

	Environmental Management and Co-ordination Act
Korea, South (Republic of)	• *Protection of Cultural Heritage Act, as amended by Act no. 8346, Apr. 11, 2007.*
Kyrgyz Republic	• *Law of the Kyrgyz Republic on the Protection of Traditional Knowledge, from July 31, 2007 of No. 116 approved by the Jogordu Kenesh of the Kyrgyz Republic June 26, 2007*
Lithuania	• *Law no. IX-1355, Law amending the law on copyright and related rights, 5 March 2003.* • *Law no. VIII-1328, Law on the principles of state protection of ethnic culture, 21 September 1999, as amended by Law No. X-484, 9 January 2006.*
Macedonia (FYR)	• *Law on Copyrights and Related Rights, of September 12, 1996, as amended by the Law of January 22, 1998*
Malawi	• *Copyright Act, 1989*
Malaysia	• *Sabah Biodiversity Enactment 2000*
Mexico	• *Federal Law on Copyright, 1996* • *General Law of Ecological Balance and Environmental Protection* • *Norma oficial Mexicana NOM-126-SEMARNAT-2000 por la que se establecen las especificaciones para la realización de actividades de colecta científica de material biológico de especies de la flora y fauna silvestres y otros recursos biológicos en el territorio nacional*
Micronesia, Fed. States of	• *Federated States of Micronesia Code: Copyright, Patents & Trademarks, 2003*
Mongolia	• *Law of Mongolia on Copyright and Related Rights, 1993 (as last amended on January 19, 2006)*
Morocco	• *Law No. 2-00 on Copyright and Related Rights (promulgated by Dahir No. 1-00-20 of 9 Kaada 1420 (15 February 2000)*
New Zealand	• *Trade Marks Act, 2002, no. 49.*
Nigeria	• *Copyright Act, chapter 68 laws of the federation of Nigeria 1999, as amended by Copyright (Amendment) Decree No 98 of 1992 and Copyright (Amendment) Decree No 42 of 1999*
Norway	• *Nature Diversity Act (Act No. 100 of June 19, 2009) Act relating to the management of biological, geological and landscape diversity* • *Patents Act (Act No. 9 of Dec. 15, 1967) as last amended by Act No. 20 of May 7, 2004*
Oman	• *Royal Decree No. 37/2000 promulgating the Law on the Protection of Copyrights and Neighboring Rights*
Palau	• *Historical and Cultural Preservation Act, 1995*

Panama	• *Law No. 20 of 26 June 2000 on the Special Intellectual Property Regime with Respect to the Collective Rights of Indigenous Peoples to the Protection and Defense of their Cultural Identity and Traditional Knowledge (Ley N° 20 del 26 de junio de 2000 sobre el Régimen Especial de Propiedad Intelectual sobre los Derechos Colectivos de los Pueblos Indígenas para la Protección y Defensa de sus Identidad Cultural y de sus Conocimientos Tradicionales, June 26, 2000 (Gaceta Oficial No. 24,083 of June 27, 2000)).* • *Executive Decree No. 12 of March 20, 2001 establishing regulations under Law No. 20 of June 26, 2000 about a Special Regime of Collective Rights of Intellectual Property of Indigenous People for Protection of their Cultural Identity and their Traditional Knowledge* • *Decreto Ejecutivo No. 257 que reglamenta el artículo 71 de la ley 41 de 1 Julio de 1998, General de Ambiente*
Papua New Guinea	• *Copyright and Neighbouring Rights Act, 2000*
Peru	• *Law introducting a Protection Regime for the Collective Knowledge of Indigenous Peoples Derived from Biological Resources, N° 27811* • *Decreto Legislativo 822, Ley Sobre el Derecho de Autor, 1996* • *Decreto Legislativo N° 1075: Decreto Legislativo que aprueba Disposiciones Complementarias a la Decisión 486 de la Comisión de la Comunidad Andina que establece el Régimen Común sobre Propiedad Industrial* • *Ley N° 29316 que modifica, incorpora y regula diversas disposiciones a fin de implementar el Acuerdo de Promoción Comercial suscrito entre el Perú y los Estados Unidos de América*
Philippines	• *Republic Act no. 8371, Indigenous Peoples Rights Act of 1997* • *Republic act 8423, Traditional and Alternative Medicine Act of 1997* • *Implementing Rules and Regulations on the Prospecting of Biological and Genetic Resources (Department Administrative Order No.96-20) 1996*
Portugal	• *Decree Law No. 118/2002 Establishing a Legal Regime for the Registration, Conservation, Legal Safeguarding and Transfer of Autochthonous Plant Material as well as Associated Knowledge*
Romania	• *Regulations for Implementing the Patent Law No. 64, 1991*
Russia	• *National Strategy of Biodiversity Conservation*
Samoa	• *Copyright Act, 1998, no. 25.*
Senegal	• *Copyright Act, 1973, and Law no. 2008-09 of January 25, 2008 on Copyright and Related Rights*
South Africa	• *National Heritage Resources Act, no. 25, 1999* • *National Environmental Management: Biodiversity Act, no. 10, 2004* • *The Patents Amendment Act No. 20 of 2005* • *Regulations on Bio-Prospecting, Access and Benefit-Sharing*

Sudan	• *Ordinance for the Protection of Antiquities, 1999*
Sweden	• *Act of April 1, 2004 (No. 2004:159) Amending the Patents Act (1967:837)*
Switzerland	• *Federal Law of June 25, 1954 on Patents for Inventions (amended as per September 1, 2008)* • *Ordinance of June 25, 2008, on the Protection of New Plant Varieties*
Tanzania	• *Copyright and Neighbouring Rights Act, 1999*
Thailand	• *Act on Protection and Promotion of Traditional Thai Medicinal Intelligence, B.E 2542 (1999)*
Tunisia	• *Loi no 94-36 du 24 fevrier 1994, relative à la Propriété Littéraire et Artistique*
Uganda	• *National Environment (Access to Genetic Resources and Benefit Sharing) Regulations, 2005, statutory instruments no. 30.* • *National Environment Statute, 1995, statute no. 4.*
Ukraine	• *Law on Copyrights and Related Rights, 2001*
United Kingdom	• *Copyright, Designs and Patents Act, 1988, c. 48.*
United States of America	• *Indian Arts and Crafts Act, 1935, as amended in 1990, P.L. 101-644.* • *Indian Arts and Crafts Enforcement Act of 2000,P.L. 106-479, 114 Stat. 2219* • *The Native American Graves Protection and Repatriation Act (NAGRPA), 1990 Pub. L. 101-601, 25 U.S.C. 3001 et seq., 104 Stat. 3048.* • *Trademark Law Treaty Implementation Act, 1998, P. L. 105-330* • *The Uniform Comparative Fault Act (UCFA)*
Vanuatu	• *Copyright and related rights act no. 42 of 2000, 29 December 2000*
Venezuela	• *Ley de Diversidad Biológica*

Documents of international organizations

African Regional Intellectual Property Organisation	• *Bangui Accord, 1977 as revised in 1999 (see Annex VII)* • *Swakopmund Protocol on the Protection of Traditional Knowledge and Expressions of Folklore, 2010*
Community of Andean Nations	• *Decision 391 on Access to Genetic Resources* • *Decision 486 Common Intellectual Property Regime* • *Decision 523 Estrategia Regional de Biodiversidad para los Países del Trópico Andino*
International Labor Organization	• *ILO Convention 169, Convention Concerning Indigenous and Tribal Peoples in Independent Countries, June 7, 1989*
Organisation of African Unity	• *African Model Legislation for the Protection of the Rights of Local Communities, Farmers and Breeders, and for the Regulation of Access to Biological Resources of 2000* • *The Constitutive Act of the African Union: adopted in 2000 at the Lome Summit (Togo), entered into force in 2001* • *OAU Model Law, Algeria, 2000 – Rights of Communities, Farmers, Breeders and Access to Biological Resources*
Pacific Islands Group Forum	• *Pacific Islands Forum Countries Traditional Knowledge Implementation Action Plan of 2009*
Secretariat for the Pacific Community	• *Guidelines for developing national legislation for the protection of traditional knowledge and expressions of culture based on the Pacific Model Law 2002, developed by the Secretariat of the Pacific Community* • *Regional Framework for the Protection of Traditional Knowledge and Expressions of Culture Model law for the Protection of Traditional Knowledge and Expressions of Culture, 2002.* • *Regional Framework on Traditional Biological Resources* • *Project No. RG-1: Support to IPR in the Pacific Region, Annex B to Pacific AfT Strategy Regional Implementation Plan 2010-14, Draft report, Artuso, F. 17 August 2009*
United Nations	• *Convention on Biological Diversity, Rio de Janeiro, 5 June 5, 1992* • *Bonn guidelines on Access to genetic resources and Fair and Equitable Sharing of the Benefits Arising Out of Their Utilization, Secretariat of the Convention on Biological Diversity, 2002* • *The International Treaty on Plan Genetic Resources for Food and Agriculture, of the Food and Agriculture Organization of the United Nations, adopted by the FAO Conference on 3 November 2001. Treaty is the successor of the International Undertaking op Plant genetic resources for Food and Agriculture of 1983* • *Global plan of action for animal genetic resources and the Interlaken declaration, adopted by the International Technical Conference on Animal Genetic Resources for Food and Agriculture, Interlaken, Switzerland, 3–7 September 2007* • *Nagoya Protocol on Access to Genetic Resources and the Fair*

	and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity, Adopted on October 29, 2010 • *UNESCO001 Model Provisions for National Laws on the Protection of Expressions of Folklore Against Illicit Exploitation and other Forms of Prejudicial Action, 1982* • *United Nations Educational, Scientific and Cultural organization Recommendation on the Safeguarding of Traditional Culture and folklore of November 15, 1989, adopted by the General Conference at its 25th session in Paris* • *United Nations Educational, Scientific and Cultural organization Symposium on the Protection of Traditional Knowledge and Expressions of Indigenous Cultures in the Pacific Islands, Noumea, 15-19 February 1999* • *The United Nations Declaration on the Rights of Indigenous Peoples, General Assembly resolution 61/295, New York, 13 September 2007*
World bank	• *Indigenous Knowledge, Local Pathways to Global Development, Marking Five Years of the World Bank Indigenous Knowledge for Development Program, Knowledge and Learning Group, Africa Region, The World Bank, 2004*
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World Intellectual Property Organization	• *WIPO Model Provisions for National Laws on the Protection of Expressions of folklore Against Illicit Exploitation and Other Prejudicial Actions of 1982, section 2* • *WIPO Report on Fact-Finding Missions on Intellectual Property and Traditional Knowledge (1998-1999), April 2001* • *WIPO/GRTKF/IC/12/4(b)* • *WIPO/GRTKF/IC/12/5(b)* • *WIPO/GRTKF/IC/13/4(b) Rev.* • *WIPO/GRTKF/IC/13/5(b) Rev.* • *WIPO/GRTKF/IC/20/INF/13, Glossary of key terms related to intellectual property and genetic resources, traditional knowledge and traditional cultural expressions, from December 7, 2011* • *WIPO/GRTKF/IC/22/4* • *WIPO/GRTKF/IC/3/10* • *WIPO/GRTKF/IC/3/9, WIPO Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and folklore, Traditional Knowledge – Operational Terms and Definitions, 20 May 2002* • *WO/GA/26/6.* • *WO/GA/40/7 Matters Concerning the Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore (IGC), incorporating Draft Articles on Traditional Knowledge as Prepared at IGC 19 (July 18 to 22, 2011)* • *World Intellectual Property Organization Copyright Treaty, Geneva, December 20, 1996*

	• *World Intellectual Property Organization Performances and Phonograms Treaty, Geneva, December 20, 1996*
World Trade Organization	• *IP/C/M/24* • *IP/C/M/25* • *IP/C/M/28* • *IP/C/M/29* • *IP/C/M/30* • *IP/C/M/32* • *IP/C/M/33* • *IP/C/M/36/Add.1* • *IP/C/M/37/Add.1* • *IP/C/M/38* • *IP/C/M/39* • *IP/C/M/40* • *IP/C/M/42* • *IP/C/M/43* • *IP/C/M/44* • *IP/C/M/45* • *IP/C/M/46* • *IP/C/M/47* • *IP/C/M/48* • *IP/C/M/49* • *IP/C/W/165* • *IP/C/W/166* • *IP/C/W/195* • *IP/C/W/198* • *IP/C/W/206* • *IP/C/W/209* • *IP/C/W/228* • *IP/C/W/236* • *IP/C/W/254* • *IP/C/W/257* • *IP/C/W/284* • *IP/C/W/310* • *IP/C/W/341* • *IP/C/W/356* • *IP/C/W/370/Rev.1, 9 March 2006, Council for Trade-Related Aspects of Intellectual Property Rights, The protection of traditional knowledge and folklore summary of issues raised and points made, note by the Secretariat, Revision.* • *IP/C/W/383* • *IP/C/W/393* • *IP/C/W/400 Rev.1* • *IP/C/W/403* • *IP/C/W/404* • *IP/C/W/423* • *IP/C/W/433*

	• *IP/C/W/434* • *IP/C/W/447* • *IP/C/W/449* • *IP/C/W/570* • *IP/C/W/571* • *Trade Related Aspects of Intellectual Property Rights, Annex 1C of the Marrakesh Agreement Establishing the World Trade Organization, Marrakesh, April 15, 1994.* • *WT/GC/W/282* • *WT/GC/W/302* • *WT/GC/W/362* • *WT/MIN(01)/DEC/1, Ministerial declaration adopted on 14 November 2001, WTO ministerial conference fourth session Doha, 9-14 November 2001*
Other International treaties	• *Anti-Counterfeiting Trade Agreement, Tokyo, April 15, 2011, not in force* • *Berne convention for the protection of literary and artistic works, as revised in Paris, July 24, 1971* • *The Convention for the Protection of Migratory Birds, August 16 – December 8, 1916, between the USA and the UK, 39 Stat. 1702* • *The Convention for the Regulation of Whaling, September 24, 1931, 49 Stat. 3079, 155 L.N.T.S. 349*

Jurisprudence

Allen v. Perry, 722 S.W.2d 98, 100 (Mo. Ct. App. 1986)

Dobson v. Louisiana Power and Light Co., 567 So.2d 569 (La. 1990)

Griffin v. LeCompte, 471 So. 2d 1382, 1389 (La. 1985)

Jensen v. ARA Services, Inc., 719 S.W.2d 121, 122 (Mo. Ct. App. 1986

*Li v. Yellow Cab Co.*532 P.2d 1226 (Cal. 1975)

McIntyre v. Balentine, 833 S.W.2d 52 (Tenn. 1992)

Stanford v. Chevrolet Division of General Motors, 642 P.2d 624 (or. 1982)

United States v. Carroll Towing Co., 159 F.2d 169 (2d. Cir. 1947)

Vincent v. Pabst Brewing Co., 47 Wis. 2d 120, 123, 177 N.W.2d 513, 514 (1970)

Watson v. State Farm Fire & Cas. Ins. Co., 469 So. 2d 967 (La. 1985)

Wilson v. R&C Serv, Co, CV990081115S, 2003 WL 716658 (Conn. Super. Ct. Feb. 19, 2003)

Samenvatting (Summary in Dutch)

Als er een centraal thema is in deze dissertatie, dan is het dat in iedere fase van het juridische proces juridische vraagstukken gebaat kunnen zijn bij economische analyse. Of het nu is door het achteraf verklaren van juridische constructies vanuit een speltheoretisch perspectief, of door het gebruik van economische concepten om juridische wetgevende beslissingen vooraf te informeren

Deze dissertatie voegt een aantal artikelen samen die zich op de intersectie van de economische en de juridische wetenschappen bevinden. Onderzoekers in elk van deze velden kunnen leren van de inzichten vergaard in het andere veld. Door het interdisciplinaire karakter van deze dissertatie zijn de verschillende hoofdstukken voor een wisselend publiek geschreven. Sommige zijn gericht op juristen en introduceren inzichten en technieken van de economie. Andere hoofdstukken zijn gericht op economen en introduceren nieuwe toepassingen en contexten voor bekende economische concepten. Deze verschillen in doelgroepen zijn de redenen waarom in sommige hoofdstukken de nadruk meer ligt op economische en in andere hoofdstukken de nadruk meer ligt op juridische vraagstukken.

De economische wetenschap kan helpen bij het bepalen van motivering van het gedrag van individuen, zowel in situaties van zekerheid als in situaties van onzekerheid, door te kijken naar prikkels en mogelijke gevolgen van externe drijfveren en mogelijke gevolgen van keuzes in gedragingen. Dit wordt zowel in hoofdstuk 2 als in hoofdstuk 5 gedaan. De economische wetenschap kan ook inzicht geven in de beweegredenen en doelstellingen van wetten. Dit word gedaan in de hoofdstukken 2 en 3, waar economische methodes worden toegepast of juridische vraagstukken. De economische wetenschap kan ook helpen verklaren hoe individuele voorkeuren en informatieasymmetrie de uitkomsten van onderhandelingen tussen meerdere partijen kunnen beïnvloeden. Dit wordt gedaan in de hoofdstukken 4 en 5, waar economische concepten worden toegepast in juridische contexten.

Hoofdstuk 2 bespreekt de onderliggende gedachte van het aansprakelijkheidsrecht. Het beschrijft situaties waarin individuen beslissen om al dan niet een maatregel te nemen, om de mogelijkheid van het ontstaan van schade te voorkomen. Bijvoorbeeld een fietser die besluit om al dan niet een helm te dragen om zichzelf te beschermen tegen hoofdletsel. Echter, of de fietser al dan niet hoofdletsel oploopt hangt ook af van het gedrag van andere

individuen, in dit voorbeeld een autobestuurder. De bestuurder kan beslissen om al dan niet in zijn spiegels te kijken voor hij een bocht neemt en zo beïnvloedt hij of de fietser mogelijk hoofdletsel oploopt. Als de schade zich voordoet, dan is daar ook nog de rechter, die achteraf moet beslissen of de fietser een helm droeg, of de bestuurder over zijn schouder keek, en of men van deze beiden individuen mocht verwachten dat ze dat deden, om tot de conclusie te komen of een van deze twee individuen schuld kan worden aangerekend. En uiteindelijk moet de rechter de nalatigheidregels toepassen en besluiten welk individu de schade moet betalen.

Er bestaan verschillende nalatigheidsregels voor het toebedelen van schade in geval van toerekenbare nalatigheid van meerdere personen. Echter proportionele schadetoebedeling, evenredig naar mate van veroorzaken door toerekenbare gedragingen, is de meest gangbare toegepaste regel, zowel in Europa als in de VS.[277] In hoofdstuk 2 gebruiken we speltheorie om aan te tonen dat de specifieke nalatigheidsregel van proportionele schadetoebedeling motieven creëert die efficiënt gedrag stimuleren in bepaalde situaties waar andere nalatigheidsregels geen efficiënt gedrag stimuleren. Een rechter kan fouten maken bij het beoordelen van wat de optimale gedragingen waren die verwacht mochten worden van de individuen, bijvoorbeeld door de verwachtingen te hoog te stellen. In het voorbeeld van de fietser en de bestuurder kan de rechter bijvoorbeeld stellen dat de fietser volledige lichaamsbescherming moest dragen en dat de bestuurder bij elke kruising moest stoppen, uitstappen en controleren of er een fietser in de buurt was. In dergelijke situaties, waar rechters fouten maken in het bepalen van de naar redelijkheid te verwachten gedragingsnorm, kan nalatigheid, of het niet volgen van de gestelde zorgvuldigheidseisen, weleens de optimale gedraging zijn.

De intuïtie hierachter is dat een proportionele toebedeling van de schade de kosten verdeelt tussen de twee betrokkenen, in tegenstelling tot andere nalatigheidsregels welke de kosten toekennen aan slechts één individu. Als één individu de kosten van de gehele schade verwacht te zullen dragen, is de drempel om nalatig te zijn relatief hoog. En als dit individu eenmaal besluit om niet nalatig te zijn, worden de verwachte kosten van de volledige schade in hun geheel overgedragen aan de andere betrokkene, indien deze ervoor kiest nalatig te handelen. Wat ook voor dit individu een relatief hoge drempel voor nalatigheid opwerpt. Het delen van de last bij een proportionele toebedeling van de schade

[277] Curran (1992); Calabresi (1997 p. 2206); Best (2007); Robinette en Sherland (2003); van Dam (2006, pp. 334-335); en Artigot I Golobardes en Gomez Pomar (2009, pp 48-52).

verlaagt de verwachte kosten van nalatigheid voor beide partijen, en verlaagt daarmee de drempel voor nalatig gedrag voor beide betrokkenen.

We laten zien dat proportionele toebedeling van de schade efficiënt is in situaties waar andere toebedelingsregels dat niet zijn. We laten ook zien dat de optimale proportionele toebedelingsregel een reflectie is dan de gewogen relatieve afwijking van de gestelde norm door de betrokken individuen .

Hoofdstuk 3 laat zien dat de toepassing van statistische methoden inzicht kan bieden in de rechtsvergelijking. Een gestructureerd overzicht is gecreëerd van alle bestaande wetgevingen aangaande een specifiek onderwerp: de bescherming van traditionele kennis (TK). En een factor analyse zorgt voor inzicht in de concepten die ten grondslag liggen aan de wetgeving. Tot dit inzicht was men top op heden nog niet gekomen met conventionele methoden van rechtsvergelijking. Door de toepassing van deze methodologie wordt een Theorie van Drie Benaderingen geïntroduceerd, die uitlegt dat de bestaande wetgeving met betrekking tot de bescherming van TK onderverdeeld kan worden in drie verschillende benaderingen elk met specifieke karakteristieken, zoals het doel van de wetgeving, waar de wetgeving de TK tegen beschermt, en voor wie de TK wordt beschermd. De drie benaderingen zijn: de economische instaatstellingsbenadering, waarmee de wetgever tracht mogelijkheden te creëren voor de economisch zwakkere inheemse groepen in de samenleving, om hun TK te gelde te maken; de conserverende beschermingsbenadering, waarmee de wetgever folklore wil veiligstellen voor de toekomst ten behoeve van het land in zijn geheel; en als laatste de culturele integriteitsbenadering, waarmee de wetgever beledigend en oneigenlijk gebruik van heilige cultuur, historische voorwerpen en authentieke producten beoogt te voorkomen. Er is aangetoond dat de Theorie van de Drie Benaderingen tot 81% van de variatie in de wetgeving verklaart.

Hoofdstuk 4 past economische concepten toe die grotendeels ontleend zijn aan de economische theorie van federalisme om de mogelijke voordelen van hypothetische internationale verdragen te analyseren. Hoofdstuk 4 gaat door op het onderwerp van TK. Het past de resultaten van hoofdstuk 3 toe, en gebruikt de Theorie van de Drie Benaderingen als een indicator voor de voorkeuren van de onderhandelende partijen in de internationale onderhandelingen over de bescherming van TK. Het analyseert de redenen dat de internationale onderhandelingen over dit onderwerp tot op heden niet succesvol zijn. Het bespreekt de mogelijkheden voor efficiëntie- en effectiviteitswinst en -verlies in het reguleren van de bescherming van TK, als er internationale verdragen worden gesloten.

Uiteindelijk wordt er tot een conclusie gekomen welke benaderingen het meest te winnen hebben van internationale onderhandelingen, en welke benaderingen niet.

Hoofdstuk 5 analyseert de grondmotieven van het gedrag van individuen in situaties van onzekerheid. Het bespreekt het verzamelen en verwerken van informatie in groepsprocessen in groepen die een optimale beslissing proberen te nemen onder onzekerheid over de gevolgen van die beslissing, gebaseerd op de aanwezige informatie bij de aanwezige groepsleden. Statistische methoden worden gebruikt om een analytisch raamwerk te creëren om om te gaan met verschillende soorten keuzes. Dit analytisch raamwerk is het Algemene Jury Theorema. We laten zien dat het Algemene Jury Theorema gebruikt zou moeten worden om het gedrag van juryleden te voorspellen in situaties waarin juryleden een gemeenschappelijk doel delen en onderling kunnen communiceren voor het stemmen.

De intuïtie achter het Algemene Jury Theorema bouwt voort op de originele aanname van Ramond Llull (1232-1316) dat de kwaliteit van een beslissing, die gebaseerd is op het samenvoegen van individuele stukken informatie, bepaald wordt door de kwaliteit van de individuele stukken informatie en door de manier waarop de informatie wordt samengevoegd. Het Algemene Jury Theorema laat zien dat het in het belang van alle juryleden is om de hun beschikbare informatie waarheidsgetrouw te delen met de andere juryleden, zolang als de individuele juryleden een gemeenschappelijk doel delen en de mogelijkheid hebben om te communiceren voor het stemmen. De reden hiervoor is dat dit hen in staat stelt de beslissing te nemen die het beste aansluit bij hun gedeelde voorkeuren. Als alle informatie eenmaal gedeeld is, zal de beslissing unaniem genomen kunnen worden, omdat de optimale beslissing dan bekend is. Dit betekent dat er volledige openheid van informatie is tussen de juryleden in equilibrium, ongeacht welke stemmingsregel wordt gebruikt.

Ons raamwerk bouwt voort op Condorcet's Jury Theorema, echter, Condorcet's Jury Theorema kan alleen worden toegepast op binaire keuzes, terwijl het Algemene Jury Theorema kan worden toegepast op een breder arsenaal aan keuzes, inclusief beslissingen over een continuüm. In andere woorden, Condorcet's Jury Theorema kan worden toegepast op jury's die te maken hebben met ja/nee vraagstukken, zoals de vraag of een verdachte schuldig is of niet. Het Algemene Jury Theorema kan worden toegepast op bredere vraagstellingen, zoals de beslissing wat de maximum snelheid moet zijn op een snelweg. Condorcet's Jury Theorema kan worden gezien als een specifieke toepassing van het Algemene Jury Theorema.

Hoofdstuk 6 concludeert en geeft een korte bespreking van mogelijke richtingen voor verder onderzoek dat voortbouwt op het hier gepresenteerde werk.

Tinbergen Institute Research Series

The Tinbergen Institute is the Institute for Economic Research, which was founded in 1987 by the Faculties of Economics and Econometrics of the Erasmus University Rotterdam, University of Amsterdam and VU University Amsterdam. The Institute is named after the late Professor Jan Tinbergen, Dutch Nobel Prize laureate in economics in 1969. The Tinbergen Institute is located in Amsterdam and Rotterdam. The following books recently appeared in the Tinbergen Institute Research Series:

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