Intergenerational solidarity, human values and consideration of the future

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Abstract

In order to advance our understanding of our individual and collective attitudes and behaviour towards the future, this interdisciplinary thesis constructs and explores psychometric and econometric measures of values, consideration of future consequences and intergenerational solidarity. First, a novel global index of intergenerational solidarity combining environmental, economic and social dimensions is constructed to enable intra- and international comparisons of the flows of capital that make up the inheritance of future generations. This covers >90% of world population in 120 countries and reveals striking global patterns, with Confucian and Nordic countries scoring above-average, and will facilitate further research into intergenerational solidarity. Second, the links between basic human values and consideration of future consequences in a sample (n=833) of Icelandic students are explored after robust validation of newly-translated measurement constructs, revealing that values predict a quarter of the variation in future orientation. Further patterns and implications for further research are discussed.

For Bec

and for the old people planting trees

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Acknowledgements

1 Introduction

This thesis is about measurement.

For as long as people have existed, we have saved, planned, bequeathed, and built for the future. Until recently, this behaviour was given little explicit scientific attention but now that we are more aware of the long-term consequences of our collective actions, it is important that we empirically address some difficult, important questions: "What drives us to act for the future? How much do we do it?"

For the first time, we have the national accounts, psychological models and computational power to begin making quantitative responses. While the work in this thesis does not answer these questions by itself, it does reveal fundamental components to any answer and also constructs comparative tools that are useful in their own right.

First are two articles that will be submitted for publication in psychology journals. The former assesses the structure and validity of a commonly used model of human values in Iceland for the first time, and the latter uses this model to examine the relationships between this dominant values model and consideration of future consequences, something that has never been done. Values are, as I show, closely related to our consideration of future consequences, and thus help to answer the question of "why?" posed above.

Second is a monograph that constructs an index of national intergenerational solidarity, pursuing the question of "how much?" in terms of capital flows. While it is not possible to quantify everything that might be called 'solidarity' in common units, this index can be used for comparison within and between countries, and addresses a current gap in the literature. It should be of particular use to researchers examining reasons for variations in the legacies that current generations leave to future generations.

Each paper contains a more detailed introduction to its subject and stands alone, but all are linked through their interdisciplinary focus on our individual and collective attitudes and behaviours towards the future and future generations.

2 An Icelandic translation and validation of the revised 19-value Portrait Values Questionnaire

2.1 Abstract

This study develops and validates the first Icelandic translation of the revised, 19-value Portrait Value Questionnaire in a student sample (n=833) using confirmatory factor analysis and multidimensional scaling. It also provides further support for the discriminant validity of the 19-value partitioning of the Schwartz values continuum, and is a necessary step to increasing Iceland's participation in cross-cultural social psychology research.

2.2 Introduction

The Schwartz values model is "the most fully elaborated, empirically grounded, and widely used theory of basic values" (Cieciuch, Schwartz, & Vecchione, 2013, p. 1215) where values are defined as "desirable, trans-situational goals, varying in importance, that serve as guiding principles in the life of a person or other social entity" (Schwartz, 1994, p. 21). Since the inception of the theory (Schwartz, 1992), the survey instrument used to construct the model has undergone several revisions to improve reliability, usefulness and validity across cultures.

Before the current study, there wasn't an Icelandic translation of the most recent and substantial update to the instrument, the revised version of the Portrait Values Questionnaire (Schwartz et al., 2012). This update refined the partitioning of the model's circular continuum from 10 segments into 19 by subdividing existing values and adding intermediate ones (Figure 1). In fact, the only existing Icelandic translation measuring Schwartz' values was a version of the PVQ-21 which, due to the length limitations of the European Social Survey, is too short to satisfactorily discriminate between 10 values (Knoppen & Saris, 2009).

Given the instrument's importance in national and cross-cultural social research, a validated translation is of considerable use to the research community. In addition, the revision has only been tested in nine languages (Schwartz & Butenko, 2014), none of which are Scandinavian, so this study allows for a further check of the theory's convergent and discriminant validity in a different language branch and culture.
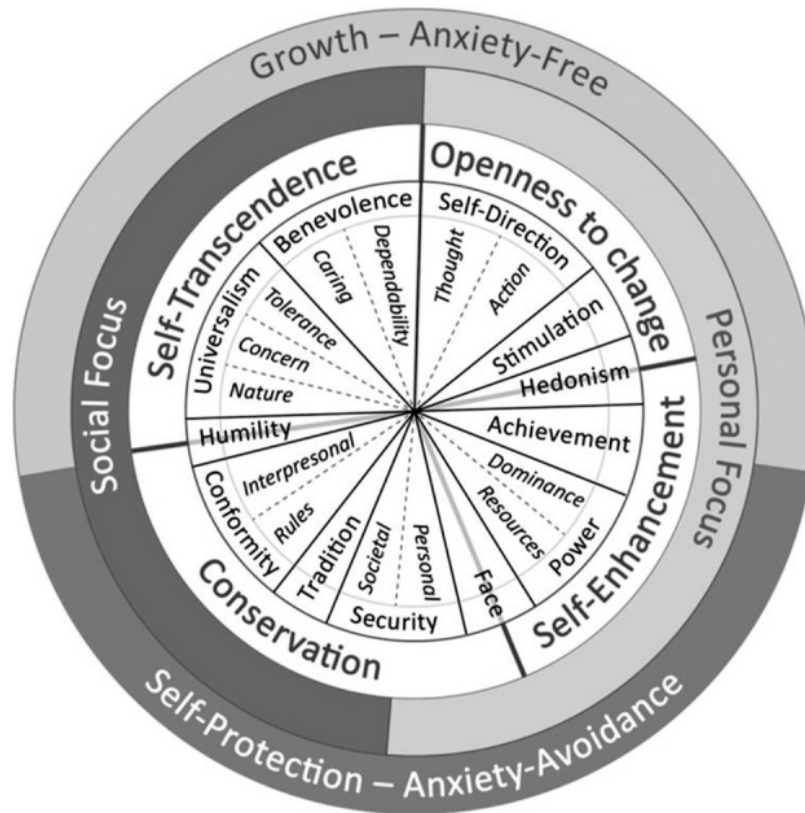
Figure 1: The 19-value model, with 10-, 4- and 2-value labels written circumferentially (Schwartz et al., 2012).

2.3 Method

2.3.1 Participants and procedure

Data was collected via survey from a convenience sample using university mailing lists, which gathered 931 responses (71.3% female; M_{age}= 29.79 SD_{age}=±9.74). Participation was voluntary and anonymous and responses were incentivised by a restaurant voucher.

2.3.2 Measurements

The latest revision of the Portrait Values Questionnaire (PVQ-RR; see Appendix I) was used (Schwartz et al., 2012). The questionnaire includes 57 items in total, 3 items to measure each of the 19 values. Each item describes a person (e.g. "It is important to him to form his views independently.") and respondents are asked to answer the question "How much like you is this person?" using a 6-point Likert-type scale (1 = Not like me at all to 6 = Very much like me). Two versions of the questionnaire exist: male and female versions. Respondents choose which version they respond to, depending on how they identify their gender.

The latest English version of the PVQ-RR was parallel-translated into Icelandic by two native speakers, back-translated into English by a translator blind to the original, and assessed for revision by Schwartz. This process was repeated three times with independent back-translation of the amended items until an acceptable consistency with the original was reached (Appendix II).

2.3.3 Analysis

In line with standard protocol (Schwartz & Littrell, 2007), respondents that used the same scale anchor ≥35 times, left ≥15 items blank, or did not use ≥2 of the scale anchors were excluded from

analysis, leaving *n* = 833 (71.3% female; M_{age}= 29.79 SD_{age}=±9.74) from 931 responses. Value averages, each based on three items, were calculated and then centred as recommended by the protocol i.e. expressed as 'difference from the individual average response'. Missing data were estimated using the Expectation Maximisation model (Schafer, 1997, p. 57) after a check for randomness (Little's MCAR test, *p* < .001).

We then used multidimensional scaling (MDS) to examine the spatial relationships of values using SPSS PROXSCAL with Euclidean distances, standardized Z-score transformation and ordinal proximity transformations. A custom start matrix was created (Bilsky, Janik, & Schwartz, 2010) with a starting co-ordinate for each value estimated trigonometrically at 19º intervals around the perimeter of a perfect 1-unit diameter circle. Theory-based improvements were then made on the custom start until it had a difference of <.01 in any of the stress indices (Kruskal's Stress-I, dispersion accounted for, Tucker's Coefficient of Congruence) compared to a blind Torgerson start. As the data are many and noisy, there are a great number of arrangements that are of similar quality; this method allows a researcher to choose one that resembles the theory, whilst revealing significant deviations in the order.

Using the order of values found in this manner, we constructed models for confirmatory factor analysis (CFA) using SPSS AMOS. The analysis was split into the four highest-order value domains (Table 1; see Figure 2 for an example), a so-called "magnifying glass" strategy (Cieciuch & Schwartz, 2012). Values on the border of higher-order domains were grouped with the closest domain.
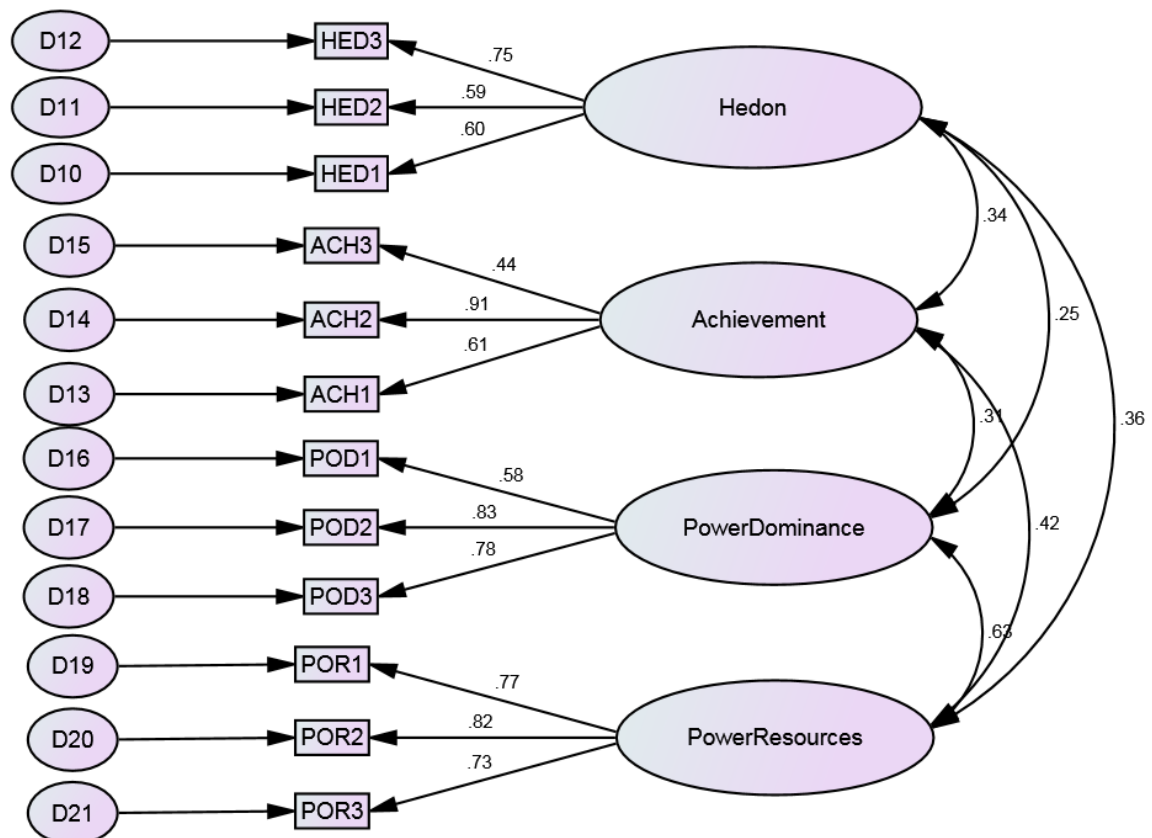
Figure 2: Self-Enhancement model for analysis of four latent values showing factor loadings and covariances.

Table 1: Definitions and groupings of values used to partition the CFA (Schwartz et al., 2012). Values with asterisks are normally on the border of two higher-order values (Figure 1); in the CFA Hedonism was placed in Self-Enhancement, Face in Conservation and Humility in Self-Transcendence based on the results of MDS.

Value	Conceptual definitions in terms of motivational goals
Self-direction–thought	Freedom to cultivate one's own ideas and abilities
Self-direction–action	Freedom to determine one's own actions
Stimulation	Excitement, novelty, and change
Hedonism*	Pleasure and sensuous gratification
Achievement	Success according to social standards
Power–dominance	Power through exercising control over people
Power–resources	Power through control of material and social resources
Face*	Security and power through maintaining one's public image and avoiding humiliation
Security–personal	Safety in one's immediate environment
Security–societal	Safety and stability in the wider society
Tradition	Maintaining and preserving cultural, family, or religious traditions
Conformity–rules	Compliance with rules, laws, and formal obligations
Conformity–interpersonal	Avoidance of upsetting or harming other people
Humility*	Recognizing one's insignificance in the larger scheme of things
Benevolence–dependability	Being a reliable and trustworthy member of the ingroup
Benevolence–caring	Devotion to the welfare of ingroup members
Universalism–concern	Commitment to equality, justice, and protection for all people
Universalism–nature	Preservation of the natural environment
Universalism-tolerance	Acceptance and understanding of those who are different from oneself

The purpose of this is to account for the circular structure of the model, whereby items would be expected to positively cross-load on adjacent values and perhaps negatively correlate with those on the opposite side of the circle. Thus, by using a "magnifying glass", we at least remove the problem of theory-predicted negative cross-loadings, which tend to obscure the distinctions between closely-related values in larger CFAs and also incorrectly lead the model fit indices to show a misspecification. In addition, it lowers the number of parameters considerably (from 205 to a maximum of 69 in the Conservation and Self-Transcendence groupings), allowing a smaller sample size to be reliably tested.

We ran a standard (rather than categorical) CFA as it is relatively robust to modest violations of normality with ordinal data (see Davidov, Datler, Schmidt, & Schwartz, 2011; Flora & Curran, 2004). Curran, West, & Finch, (1996) advise concern if skewness ≥ 2 and kurtosis ≥ 7; none of our data exceeded this.

We followed (Cieciuch, Davidov, Vecchione, Beierlein, & Schwartz, 2014) in treating CFI values ≥ 0.90, SRMR values ≤ 0.08, and RMSEA values ≤ 0.08 as indicators of reasonable fit for the models, and values of ≤ 0.05 for the latter indices as indicating good fit (Bentler, 1990; Hu & Bentler, 1999; Marsh, Hau, & Wen, 2004). As we were checking for how particular items affected the overall model structure, we checked modification indices to see if the fit could be improved by dropping items. Items with significant modification indexes ($\Delta\chi^2 \geq 3.84$; $\alpha = .05$, df = 1; Brown, 2015) that were expected to change the parameter (EPC) by more than 0.2 were examined for removal after Saris, Knoppen, & Schwartz, (2013).

2.3.4 Results
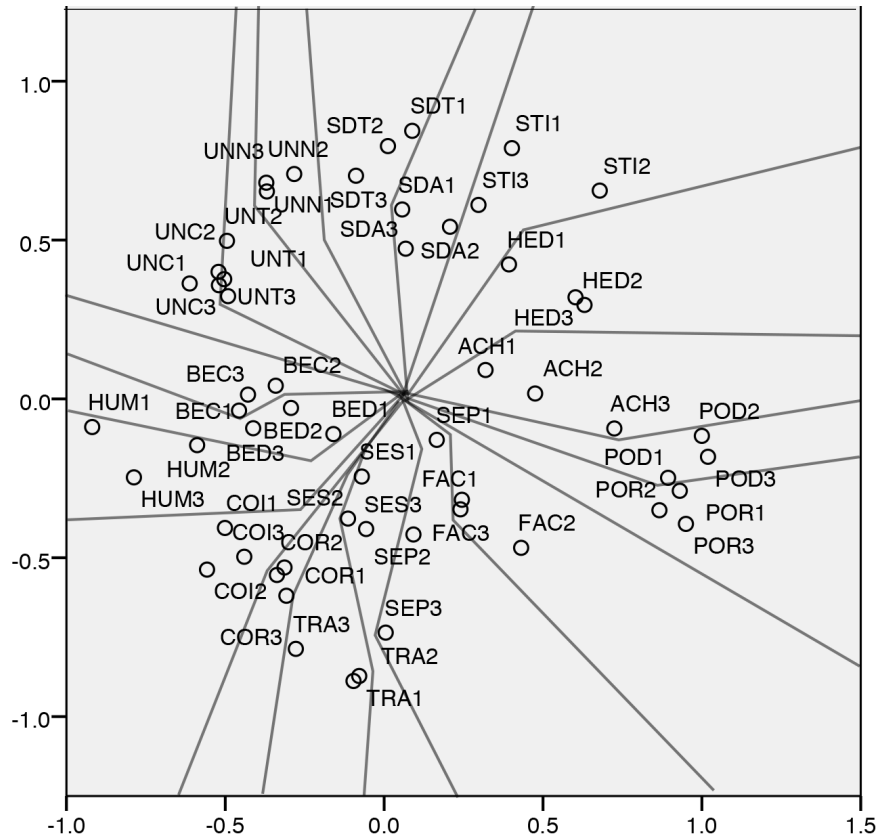
Figure 3: MDS results showing items clustered into 19 values. Stress 1 = 0.20, dispersion accounted for = 0.96, Tucker's Coefficient of Congruence =0.98.

Table 2: CFA Goodness of Fit Indices.

Model	df	χ^2	CFI	SRMR	RMSEA {90% confidence interval}
Openness to Change	24	88.98	0.968	0.0440	.057 {.045 | .070}
Conservation	120	380.97	0.952	0.0450	.051 {.045 | .057}
Self-Enhancement	48	255.12	0.933	0.0700	.072 {.063| .081)
Self-Transcendence	120	318.50	0.963	0.0371	.045 {.039 | .051}
Self-Transcendence (Benevolence values combined)	121	537.75	0.922	0.0941	.064 {.059 | .070}
Openness to Change (Self-Direction values combined)	25	294.24	0.867	0.1324	.114 {.102 | .126}
Self-Enhancement (ACH3 dropped; Achievement variance fixed to 1)	39	150.91	0.961	0.0459	.059 {.049 | .069}

The MDS arrangement shown in Figure 3 is the result of our theory-based adjustments to the custom start matrix. All values could be partitioned using the standard polar method; although there

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are a number of angles in the partition lines, the most important things is that items indexing the same value could theoretically be joined (forming triangles in this case) without intersecting other groupings (Cieciuch & Schwartz, 2012). Also, Borg & Groenen (2005) note that curved partition lines are mathematically identical to straight ones.

Encouragingly, three of the CFA models fit well in the first instance (Table 2). The Self-Enhancement model, while acceptable, was near the cut-offs on RMSEA and SRMR. Dropping the ACH3 item improved the model fit but its item-total correlation was greater than 0.3 (Table 3) a commonly-used minimum cut-off (Field, 2013). Given that there are theory-based reasons for keeping the item (explored further in the discussion) and that it did not prejudice the model's overall fit, we decided to keep it.

Two pairs of values had model inter-correlations greater than 0.75: Benevolence-Caring with Benevolence-Dependability (0.89) and Self-Direction-Thought with Self-Direction-Action (0.76). Following the method of Schwartz & Butenko (2014) we reran the CFA with their correlations fixed at 1 to see if it improved model fit; in both cases the CFI, RMSEA and SRMR were considerably worse (Table 2) giving no justification to combine them.

Table 3 shows the loadings of individual items on their latent factors. All factors loaded >0.4 on their latent variable apart from ACH3 (0.398). The Index of Quality was >0.7 in all instances, indicating a generally good reliability.

Table 3: Means, standard error and standardised regression weights of value items on their latent values. Items in italics were dropped. The Index of Quality is the square root of the sum of the factor loadings, after Schwartz & Butenko, (2014) and is a measure of the correlation between the observed and latent variables (Saris & Gallhofer, 2007).

Value	Item	Item Mean	Item SE	Value Mean	Value SE	Factor Loading	Index of Quality
Self-direction–thought	SDT1	5.07	0.04	4.95	0.03	0.75	0.812
	SDT2	5.02	0.03			0.76	
	SDT3	4.75	0.04			0.47	
Self-direction–action	SDA1	5.41	0.03	5.20	0.02	0.77	0.833
	SDA2	4.79	0.04			0.58	
	SDA3	5.41	0.03			0.74	
Stimulation	STI1	3.77	0.05	3.95	0.04	0.53	0.820
	STI2	3.52	0.05			0.65	
	STI3	4.56	0.04			0.84	
Hedonism	HED1	5.02	0.03	4.37	0.03	0.60	0.805
	HED2	4.49	0.04			0.59	
	HED3	3.61	0.05			0.75	
Achievement	ACH1	5.21	0.03	4.62	0.03	0.61	0.810
	ACH2	4.88	0.04			0.91	
	ACH3	3.78	0.05			0.45	
Power–dominance	POD1	3.13	0.04	2.67	0.04	0.58	0.854
	POD2	2.36	0.05			0.83	
	POD3	2.51	0.05			0.78	
Power–resources	POR1	2.94	0.05	2.71	0.04	0.77	0.878
	POR2	3.15	0.05			0.82	
	POR3	2.04	0.04			0.73	
Face	FAC1	4.57	0.04	4.41	0.04	0.70	0.820
	FAC2	4.15	0.04			0.49	

	FAC3	4.52	0.05			0.83	
Security–personal	SEP1	4.75	0.04	4.42	0.03	0.40	0.733
	SEP2	5.02	0.04			0.59	
	SEP3	3.49	0.05			0.62	
Security–societal	SES1	5.25	0.03	4.64	0.03	0.54	0.807
	SES2	4.51	0.04			0.62	
	SES3	4.16	0.05			0.80	
Tradition	TRA1	3.38	0.05	3.02	0.04	0.73	0.837
	TRA2	2.65	0.05			0.70	
	TRA3	3.02	0.05			0.67	
Conformity–rules	COR1	4.37	0.05	4.00	0.05	0.88	0.932
	COR2	3.84	0.05			0.83	
	COR3	3.79	0.05			0.89	
Conformity–interpersonal	COI1	4.59	0.05	3.91	0.04	0.73	0.894
	COI2	3.47	0.05			0.80	
	COI3	3.66	0.05			0.87	
Humility	HUM1	3.38	0.05	3.80	0.03	0.43	0.705
	HUM2	4.40	0.04			0.58	
	HUM3	3.64	0.05			0.49	
Universalism–nature	UNN1	4.50	0.04	4.05	0.04	0.84	0.917
	UNN2	3.42	0.05			0.80	
	UNN3	4.23	0.05			0.88	
Universalism–concern	UNC1	4.90	0.04	4.97	0.03	0.67	0.869
	UNC2	4.85	0.04			0.80	
	UNC3	5.15	0.04			0.80	
Universalism–tolerance	UNT1	5.13	0.04	4.85	0.03	0.77	0.839
	UNT2	4.68	0.04			0.73	
	UNT3	4.73	0.04			0.61	
Benevolence–dependability	BED1	5.26	0.03	5.14	0.03	0.60	0.801
	BED2	5.49	0.02			0.70	
	BED3	4.61	0.04			0.63	
Benevolence–caring	BEC1	5.24	0.03	5.12	0.03	0.74	0.855
	BEC2	5.51	0.03			0.83	
	BEC3	4.68	0.04			0.63	

Table 4: Correlations between values. The theory predicts that the pattern of correlations will resemble a cosine wave.

	Self-direction–thought	Self-direction–action	Stimulation	Hedonism	Achievement	Power–dominance	Power–resources	Face	Security–personal	Security–societal	Tradition	Conformity–rules	Conformity–interpersonal	Humility	Benevolence–dependability	Benevolence–caring	Universalism–concern	Universalism-tolerance	Universalism–nature
Self-direction–thought	1																		
Self-direction–action	.46**	1																	
Stimulation	.24**	.24**	1																
Hedonism	.03	.07*	.35**	1															
Achievement	.07*	.09*	.11**	.00	1														
Power–dominance	-.03	-.02	.03	.05	.20**	1													
Power–resources	-.12**	-.08*	.06	.12**	.25**	.48**	1												
Face	-.17**	-.07*	-.18**	-.14**	.11**	.05	.16**	1											
Security–personal	-.22**	-.07*	-.42**	-.16**	-.01	-.10**	-.03	.14**	1										
Security–societal	-.14**	-.14**	-.27**	-.12**	-.12**	-.18**	-.11**	.02	.21**	1									
Tradition	-.34**	-.30**	-.21**	-.16**	-.05	.08*	.07*	-.05	.05	.04	1								
Conformity–rules	-.32**	-.26**	-.43**	-.31**	-.11**	-.17**	-.15**	-.06	.26**	.16**	.20**	1							
Conformity–interpersonal	-.40**	-.37**	-.25**	-.09**	-.23**	-.22**	-.09*	.16**	.07*	-.05	.03	.12**	1						
Humility	-.02	-.17**	-.17**	-.17**	-.36**	-.28**	-.37**	-.10**	-.03	-.05	.01	-.00	.18**	1					
Benevolence–dependability	-.02	-.01	-.07	-.05	-.01	-.14**	-.12**	-.09**	-.03	-.03	.01	.01	-.03	.00	1				
Benevolence–caring	-.06	-.04	-.12**	-.09**	-.11**	-.19**	-.21**	-.18**	-.01	-.01	-.03	.05	-.01	.01	.42**	1			
Universalism–concern	.14**	.09*	-.08*	-.08*	-.25**	-.36**	-.51**	-.22**	-.15**	.10**	-.29**	-.05	-.08*	.24**	-.05	.09**	1		
Universalism-tolerance	.18**	.13**	.09**	-0.05	-.22**	-.37**	-.44**	-.31**	-.19**	-.10**	-.25**	-.06	.01	.21**	.01	.08*	.44**	1	
Universalism–nature	.18**	0.03	.13**	-.08*	-.19**	-.18**	-.31**	-.16**	-.15**	-0.07	-.25**	-.18**	-.11**	.07*	-.23**	-.08*	.27**	.15**	1

** =p≤.01; * =p≤.05

Discussion

The results of this CFA validate the translation of the PVQ-RR into Icelandic and provide a further validation of the 19-value model in a culturally-distinct country and language branch. Previously, the only Icelandic values questionnaire was the PVQ-21, which, due to the length limitations of the European Social Survey, is too short to satisfactorily discriminate between 10 values (Knoppen & Saris, 2009).

The MDS produces a relatively consistent layout when compared to the cross-national MDS in Schwartz et al., (2012), with all value items clustering appropriately, near where predicted and with the correct oppositions. However, there are a few notable points of departure.

The most interesting is that Universalism is placed between Benevolence and Self-Direction; this was its original position (Schwartz, 1992) but it has often swapped places with Benevolence and does so in the majority of surveys using the latest theory. Schwartz et al., (2012) speculated that the enormous increase in discourse related to preserving nature, particularly its normativity and framing as a matter of human safety (e.g. regarding climate change), may have associated Universalism-Nature with the human needs for avoiding threat and fitting in and thus "dragged" Universalism towards other values that address these needs.

In our sample, the opposite was true; Universalism-Nature actually anti-correlated (Table 4) with most Conservation values (though notably not Security-Societal). One explanation might be that "...in general, climate change is not seen as a threat by the local politicians or citizens, rather as a benefit" (Lonkila, 2012). A second is that local interpretations of the word 'nature' may be different than in other countries, leading to associations with different values. Iceland's nature is a beautiful but inhospitable wilderness characterised by ferocious weather; this might not be the same 'nature' that people in other countries think of. This would go some way to explaining its relative importance to those who also value Stimulation and its position next to Self-Direction, which is unusual even for samples that have this reversal; normally Universalism-Tolerance would sit on that side. A third explanation may be that the value of nature has become a highly charged in the last decade of Icelandic politics, particularly in the context of economic sustainability. It is common for the issue to be framed as a choice between preservation of wilderness and the ability of Iceland's unstable economy to support its inhabitants (Magnason, 2008). This could explain the unusual anti-correlation of Universalism-Nature with both Benevolence values, opposite to what the theory would normally predict.

It is also possible to examine some unusual patterns in the MDS using the table of correlations in Table 4. The lack of a strong area of opposition for Benevolence-Dependability is revealed in the MDS as a tendency to sit in the centre of the circle, and for Humility to be 'pushed' towards the edge as it tries to be closer to the Universalism values it correlates with, as the theory would predict. It is interesting to note that Schwartz & Butenko (2014) also found a central tendency for Benevolence in their sample of Russian students. Likewise, Tradition is 'pushed' to the outside as it only correlates with Conformity-Rules, while both Security values and Conformity Rules are correlated with each other and Conformity-Interpersonal correlates with Face.

Despite these slight inconsistencies, the CFA indicated that no items should be dropped and all values could be distinguished from each other. The two pairs that were close, Benevolence-Caring/Benevolence-Dependability and Self-Direction-Thought/Self-Direction-Action, made the model fit worse when combined, justifying their separation. Schwartz & Butenko (2014) also found these pairs to be highly correlated, suggesting that their close relationship may be based in the construct, rather than in translation error.

Although it would improve the CFA if we remove item ACH3, we chose to retain it not only because it loaded onto its factor acceptably well, but also because of the factor's definition. Achievement ("success according to social standards") is measured with the following items:

1. It is important to him/her to have ambitions in life.

2. It is important to him/her to be very successful.

3. It is important to him/her that people recognize what s/he achieves.

It may well be that only the third item is consistently associated with the part of the definition relating to "according to social standards", yet that is integral to the value's meaning and so it may actually be beneficial to the construct to retain it. Schwartz et al., (2012) noted a definitional tension in the value and tested to see if Achievement could partition into *personal success* and *demonstrating competence* facets, but found no clear evidence for this.

2.3.5 Conclusion

This study adds support both to the cross-cultural applicability of the latest update of the Portrait Values Questionnaire and to the universality of the values that it measures. Further work might focus on better sampling; a larger and more representative study might aim to confirm the third-order structure of values in Iceland as in Cieciuch, Davidov, Vecchione, & Schwartz, (2014). It might also examine in more detail the order the change in ordering of Universalism and Benevolence, and further investigate how Icelanders view and value the natural world. These variations aside, given the robust validation that the theory and instrument has withstood, we consider both the individual items and the instrument as a whole to be well-validated and suitable for further use in Iceland and among Icelandic-speaking populations.

3 "What has posterity done for me?" Links between values and consideration of future consequences

"Two types of choices seem to me to have been crucial in tipping [past societies'] outcomes towards success or failure: long-term planning, and willingness to reconsider core values."

- Jared Diamond, "Collapse", 2006

3.1 Abstract

This study is the first attempt to examine the links between the Schwartz values model and consideration of future consequences (CFC), two separately well-studied constructs that are important motivating factors for pro-social and pro-environmental behaviour. In an Icelandic student sample (n = 833), values explain over a quarter of the variation in CFC and there is evidence that the 19-value Schwartz model and the CFC-14 scale are more useful in explaining the relationship between values and future orientation than simpler measurement models. Patterns of correlation are discussed to inform future research on the causes of variation in CFC.

3.2 Introduction

Global sustainability will require a long-term outlook centred on other people, yet we care – some argue more – about ourselves and about the immediate (Lazarus, 2009). Pro-sociality is well-studied (Fehr & Fischbacher, 2003; Penner, Dovidio, Piliavin, & Schroeder, 2005; Schwartz, 2010; Twenge, Baumeister, DeWall, Ciarocco, & Bartels, 2007) but it is odd that there is not more research into what it is that makes people more future-orientated. Princen (2009) notes (p.10):

"It would be nice if there was a single literature on this topic, or even a field of psychology or organizational behaviour... as imperative as the need is today to understand long-term decision-making, the questions have been barely posed, let alone answered."

Such an understanding would have significant relevance to research into the motivations behind necessary yet long-term behaviours such as forestry (Short & Hawe, 2012); commissioning of energy infrastructure, particularly relating to the millennial timescales of nuclear power (Nummi, Kyllönen, & Eurajoki, 2012); and reduction in certain environmentally-damaging activities such as carbon emissions and soil erosion, where costs are frontloaded and benefits backloaded over centuries (Bindraban et al., 2012; Solomon, Plattner, Knutti, & Friedlingstein, 2009).

3.2.1 Time and Values

There has been a great deal of research into the *effects* of thinking about the immediate and future consequences of our actions (e.g. in environmental, academic, health, and ethical behaviour; for a meta-analysis see Milfont, Wilson, & Diniz, 2012). However, the causes of variations in our preferences for different time horizons are not well understood. For instance, values are foundational mental constructs arising from biosocial needs (Schwartz, 1992), are largely static during adulthood (Bardi & Goodwin, 2011) and are central to our conscious and unconscious decision-making processes (Maio, Olson, Allen, & Bernard, 2001; Maio & Olson, 1998; Parks &

Guay, 2009; Schwartz, 1994).This implies they should affect our consideration of future consequences, yet only three studies exist that correlate values and time orientation (Arnocky, Milfont, & Nicol, 2013; Khachatryan, Joireman, & Casavant, 2013; Milfont & Gouveia, 2006). All use relatively blunt instruments measuring between two and five values, none have this relationship as their main focus, and their results vary considerably. Khachatryan et al. (2013) found significant relations, some strong, between all measured facets of values and time orientation, but the other two studies found only a few weak relationships between values and time orientation.

This paper explores the correlation between the Schwartz values model (Schwartz, 1992), which is the most widely-used and reliable taxonomy of values (Parks & Guay, 2009), and time orientation as measured by the Consideration of Future Consequences scale (Strathman, Gleicher, Boninger, & Edwards, 1994). Both of these scales have seen substantial recent revision to improve their internal discrimination and validity (Joireman, Shaffer, Balliet, & Strathman, 2012; Schwartz et al., 2012), which gives us greater opportunity for insight into any relationship between values and time orientation than the three studies previously mentioned.

3.2.2 Schwartz Values

The latest revision of the Schwartz values theory identifies 19 broad personal values (Table 5) which may be defined as "trans-situational goals, varying in importance, that serve as guiding principles in the life of a person or group… organized into a coherent system that underlies and can help to explain individual decision making, attitudes, and behaviour" (Schwartz et al., 2012, p. 664). In the 'coherent system' (Figure 4), values are grouped into progressively broader categories, the number of which depends largely on the aims of the researcher (Cieciuch & Schwartz, 2012). Adjacent values (e.g. Conformity and Tradition) express similar motivations and are likely to correlate with each other and with corresponding attitudes and behaviours (e.g. following social norms and customs. Opposing values (e.g. Conformity and Stimulation) express dissimilar motivations and thus underlie dissimilar attitudes and behaviours (e.g. obeying orders, or skydiving).
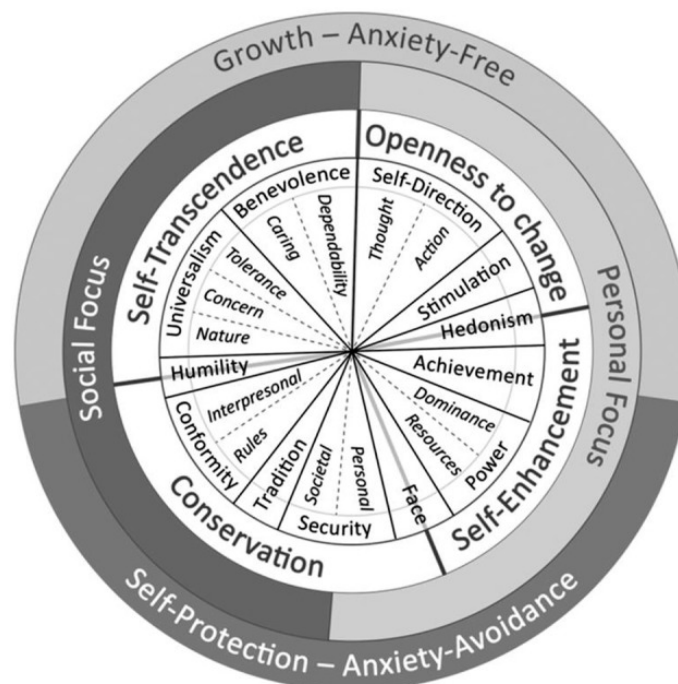

Figure 4: The 19-value model, with 10-, 4- and 2-value labels written circumferentially (Schwartz et al., 2012)

Table 5: Definitions and groupings of values (Schwartz et al., 2012).

Value	Conceptual definitions in terms of motivational goals
Self-direction–thought	Freedom to cultivate one's own ideas and abilities
Self-direction–action	Freedom to determine one's own actions
Stimulation	Excitement, novelty, and change
Hedonism	Pleasure and sensuous gratification
Achievement	Success according to social standards
Power–dominance	Power through exercising control over people
Power–resources	Power through control of material and social resources
Face	Security and power through maintaining one's public image and avoiding humiliation
Security–personal	Safety in one's immediate environment
Security–societal	Safety and stability in the wider society
Tradition	Maintaining and preserving cultural, family, or religious traditions
Conformity–rules	Compliance with rules, laws, and formal obligations
Conformity–interpersonal	Avoidance of upsetting or harming other people
Humility	Recognizing one's insignificance in the larger scheme of things
Benevolence–dependability	Being a reliable and trustworthy member of the ingroup
Benevolence–caring	Devotion to the welfare of ingroup members
Universalism–concern	Commitment to equality, justice, and protection for all people
Universalism–nature	Preservation of the natural environment
Universalism-tolerance	Acceptance and understanding of those who are different from oneself

3.2.3 Consideration of Future Consequences

Consideration of Future Consequences (CFC) is defined as "a stable individual difference in the extent to which people consider distant versus immediate consequences of potential behaviors" (Strathman et al., 1994, p. 742). Two measures of future time orientation are widely used: the CFC scale and the future portion of the Zimbardo Time Perspective Inventory (ZTPI; Zimbardo & Boyd, 1999). In this study we chose the former. It may be a more reliable construct despite being less readable (Crockett, Weinman, Hankins, & Marteau, 2009) and the CFC scale has been shown to have better predictive ability in general for behaviours with a long-term component such as smoking and alcohol use, pro-environmental behaviour and health concerns (Strathman et al., 1994).Also, it is aimed at the specific trade-off between long and short term effects of decisions as opposed to a general preoccupation with the future.

Joireman, Strathman, & Balliet, (2006) explain that there are two possible mechanisms for how CFC affects behaviour, which may occur simultaneously. First, higher CFC may indicate an increased awareness of the consequences of our actions. Second, it may indicate increased importance applied to future vs. immediate consequences, or what economists call a 'reduced discount rate' (Bruderer Enzler, 2013; Charlton, Gossett, & Charlton, 2011; Joireman, Balliet, Sprott, Spangenberg, & Schultz, 2008). CFC is correlated with a vast array of positive attitudes and behaviours related to health, pro-sociality and the environment (Joireman et al., 2012, 2006; Milfont et al., 2012).

There have been recent improvements in the CFC-scale (Joireman et al., 2012) which is now measured using two subscales tapping the importance of immediate and future consequences. CFC-Immediate is reverse-scored and summed with CFC-Future to give CFC-Total. A current research goal is to explore whether these subscales can help explain links between CFC and other variables (Joireman et al., 2012).

There is not much evidence to suggest what affects an individual's level of consideration for future consequences (Joireman et al., 2006). Aside from the studies incorporating values mentioned previously, positive correlations have been found with level of education (Toepoel, 2010), a religious upbringing (Rappange, Brouwer, & van Exel, 2009) and personality traits (Gick, 2014) and Strathman et al. (1994) hypothesise that an increase in socioeconomic status might allow the "luxury" of long-term thinking.

3.3 Aims and Hypotheses

This paper has two main aims. First, we intend to demonstrate the usefulness of Schwartz' latest theory over more simplified measures of values in predicting CFC. Second, recognising the current importance of understanding the causes of future time orientation, we aim to use the correlations with values to generate hypotheses that might further advance the understanding of what causes us to consider the future. The large number of values that can be discriminated in the Schwartz model gives a particularly fine-grained view of motivation links, facilitating this. Iceland also provides a particularly useful testing ground for this as a representative of Western nations as it has been culturally influenced by the United States and several European countries due to its political history, geographic position and hosting of NATO forces. As Western nations have the greatest environmental impact (White, 2007) it is particularly appropriate for an analysis of the connection between values and future orientation to work in the context of these countries.

Despite the sparse literature on the subject, it is possible to makes some educated guesses of what values might correlate with prioritising future consequences. Table 6 presents our tentative *a priori* predictions, based on the values definitions and existing literature. Except where noted, we supposed that a high consideration for future consequences would be a result of opposing scores in each subscale.

Table 6: Predicted relationships between values and CFC.

	CFC-F	CFC-I	CFC-T
Self Direction-Thought	?	?	?
Self Direction-Action	?	?	?
Stimulation	–	+	–
Hedonism	–	+	–
Achievement	?	?	?
Power-Dominance	+	+	?
Power-Resources	–	+	–
Face	?	?	?
Security-Personal	+	–	+
Security-Societal	+	–	+
Conformity-Rules	+	–	+
Conformity-Interpersonal	+	–	+
Tradition	?	?	?
Humility	?	?	?
Benevolence-Dependability	?	?	?
Benevolence-Caring	?	?	?

Universalism-Concern	+	−	+
Universalism-Nature	+	−	+
Universalism-Tolerance	?	?	?

First, at the broad level, we hypothesise that consideration of future consequences will generally correlate positively with values with a social focus (Figure 1) and inversely with values with a personal focus. Although CFC is aimed at personal and social outcomes, considering the consequences of our actions seems likely to mean that we more often consider their effects on other people; it is proverbial wisdom and empirical fact (Jonason & Tost, 2010) that more selfish people are not as considerate of the consequences their actions have on others.

Joireman, Anderson, & Strathman (2003) demonstrated that s*ensation seeking*, "a trait defined by the seeking of varied, novel, complex, and intense sensations and experiences and the willingness to take physical, social, legal, and financial risks for the sake of such experiences," (Zuckerman, 2007) was negatively associated with CFC. Its conceptual similarity to Hedonism and Stimulation gives us reason to propose a negative correlation with those values.

Wade-Benzoni, Hernandez, Medvec, & Messick (2008) used priming to affect intergenerational giving in an experimental set-up and found that power primes (words such as "authority, boss, control, executive, influence, and rich"; i.e. mostly Power-Dominance) increased the share of money allocated to a future participant, and that the effect of Power primes was mediated by increased feelings of social responsibility. However, research on the Dark Triad of personality traits (Jonason & Tost, 2010) has indicated that they may be negatively correlated with CFC[1] whilst being highly associated with Power and Achievement and to a lesser extent Hedonism, such that these have been characterised as "Dark Values" (Kajonius, Persson, & Jonason, 2015). Therefore, we offer no prediction for Power-Dominance, and negative for Hedonism and Power-Resources.

We also offer no prediction for achievement. Gick (2014) and Strathman et al. (1994) linked the trait of Conscientiousness to CFC, showing a negative relationship with CFC-I and positive with CFC-F. Given that it is also moderately related to Achievement, Security and Conformity values in a recent, 60-study meta-analysis (Parks-Leduc, Feldman, & Bardi, 2015), we hypothesize a similar relationship between CFC and these values, excepting Achievement as this would conflict with the Dark Triad studies and noting that Conformity has since been divided into Conformity-Rules and Conformity-Interpersonal.

Khachatryan et al. (2013) found medium and strong correlations of CFC with biospheric, altruistic and egoistic values, using a short values questionnaire based on the Schwartz model (de Groot & Steg, 2007; Stern, Dietz, Abel, Guagnano, & Kalof, 1999). Biospheric values can be considered a direct analogy to Universalism-Nature and a large number of studies relate CFC and pro-environmental attitudes and behaviours (Milfont et al., 2012). Therefore, it seems reasonable that Universalism-Nature will be related to CFC. Three of the altruistic items correspond to Universalism-Concern values, and one to Benevolence-Caring, leading us to propose that the former will relate to CFC; we considered there to be a lack of evidence for the latter, given its small contribution to a combined measure. Intriguingly, egoistic values correlated positively with both CFC-Immediate *and* CFC-Future suggesting multiple relationships within the egoistic value construct. Egoistic values are made up of two items relating to Power-Dominance, one to Achievement and one to Power-Resources, and one (*Influential*) which is unclear[2]. We therefore

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1   Though curiously, in that study gender has a large effect: the correlation is strong (r=-.52) and significant (p<.01) in men, yet there is no correlation with women.
2   "Influential" may be related to Power-Dominance, but was previously included in Achievement; the definition of

hypothesized a positive relationship between Power-Dominance and both CFC subscales, but considered there to be a lack of evidence for any other relationship. Further evidence for the relationship with of egoistic values with CFC-Immediate comes from Arnocky et al. (2013), although none of their other results were significant.

3.4 Method

3.4.1 Participants and procedure

Data was collected via survey from a convenience sample using university mailing lists, which gathered 931 responses (71.3% female; M_{age}= 29.79 SD_{age}=±9.74). Participation was voluntary and anonymous and responses were incentivised by a restaurant voucher.

3.4.2 Measurements

An online questionnaire in Icelandic was constructed and included measures of CFC and values (Appendices I and III). The order of the two instruments was randomised. Participants were also asked for their age, gender and how many children they had.

Consideration of future consequences. The latest Icelandic translation of the 14-item CFC was used (parallel- and back-translated by Saviolidis and Garðarstdóttir (2014) to common standards based on Joireman et al., 2012; see Appendix III), with a five-point Likert-type scale (1=not at all like me; 5=very much like me). There are seven items that measure CFC-Immediate (e.g. "I only act to satisfy immediate concerns, figuring the future will take care of itself."), and seven items that measure CFC-Future (e.g. "When I make a decision, I think about how it might affect me in the future." See Appendix IV for other items). To obtain CFC-Total, CFC-Immediate was reverse-scored and summed with CFC-Future.

Values. The latest revision of the Portrait Values Questionnaire (PVQ-RR) was used (Schwartz et al., 2012; See Appendix I). The questionnaire includes 57 items in total, 3 items to measure each of the 19 values. Each item describes a person (e.g. "It is important to him to form his views independently.") and respondents are asked to answer the question "How much like you is this person?" using a 6-point Likert-type scale (1 = Not like me at all to 6 = Very much like me). Two versions of the questionnaire exist: male and female versions. Respondents choose which version they respond to, depending on how they identify their gender.

The latest English version of the PVQ-RR was parallel-translated into Icelandic by two native speakers, back-translated into English by a translator blind to the original, and assessed for revision by Schwartz. This process was repeated three times with independent back-translation of the amended items until an acceptable consistency with the original was reached (Appendix II). Confirmatory factor analysis and multidimensional scaling was used to assess the reliability of this scale in a novel language (see Section 3) and confirm the order of the values.

3.4.3 Statistical analysis

In line with standard protocol (Schwartz & Littrell, 2007), respondents that used the same scale anchor ≥35 times, left ≥15 items blank, or did not use ≥2 of the scale anchors were excluded from analysis, leaving *n* = 833 from 931 responses. Value averages, each based on three items, were

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the latter category changed slightly in the 2012 revision (Schwartz et al., 2012) and "influential" was dropped from Power-Dominance due to poor reliability.

calculated and then centred – i.e. expressed as 'difference from the individual average response' – as recommended by the protocol to reduce scale-use bias.

Two sub-scales were calculated in the CFC; half of the items were averaged to yield CFC-Immediate (α=.80), and the other half to yield CFC-Future (α=.74). CFC-Immediate items were then reverse-scored and averaged with CFC-Future to yield CFC-Total (α=.85). To check whether a two-factor solution for the CFC scale was empirically acceptable, we used confirmatory factor analysis to compare the fit of a single-factor and two-factor model including the error covariances specified in Khachatryan et al. (2013), namely CFC2-CFC6, CFC6-CFC10, CFC7-CFC9, CFC8-CFC14, CFC3-CFC12, CFC3-CFC4, CFC4-CFC5, and CFC13-CFC14. The two-factor model fit the data reasonably well ($\chi^2(68) = 394.087$, SRMR $= 0.055$, CFI $= 0.904$, RMSEA $= 0.076$) by standard cut-offs (CFI ≥ 0.90, SRMR ≤ 0.08, RMSEA ≤ 0.08; Bentler, 1990; Hu & Bentler, 1999; Marsh, Hau, & Wen, 2004) even though the modification indices suggested important covariances between other errors. A chi-square difference test between the two-factor model and a one factor solution was significant ($\chi^2(1) = 153.319$, p < 0.001) indicating that the two subscales can and should be differentiated.

We then calculated partial correlations between values and CFC controlling for age, gender and parenthood and used a hierarchical regression to check the extent to which values improve predictions of CFC over demographic variables. There was an unusually broad age range for a student sample and age has been shown to influence values (Schwartz et al., 2012). Our convenience sample was also biased towards female respondents. Parenthood might be hypothesised to affect CFC although a causal link has not yet been demonstrated, and there is speculation that children may influence their parents' values (Knafo & Galansky, 2008).

3.5 Results

Partial correlations between values and CFC, after correcting for age, gender and parenthood, are shown in Table 7. Values predicted 25.4% of unique variance in CFC-Total, 20.7% in CFC-Future and 19.6% in CFC-Immediate, and the demographic variables explained very little variance in any of the scales (<.04%). Bivariate correlations between values can be seen for reference in Table 8.

Most significant CFC-Total scores were associated with negative CFC-Immediate and positive CFC-Future scores, with the exception of Power-Dominance, Security-Societal, Tradition, Universalism-Concern and Conformity-Interpersonal. Of these, the last had non-significant CFC-Immediate scores, and the rest had no significant relationship with CFC-Future.
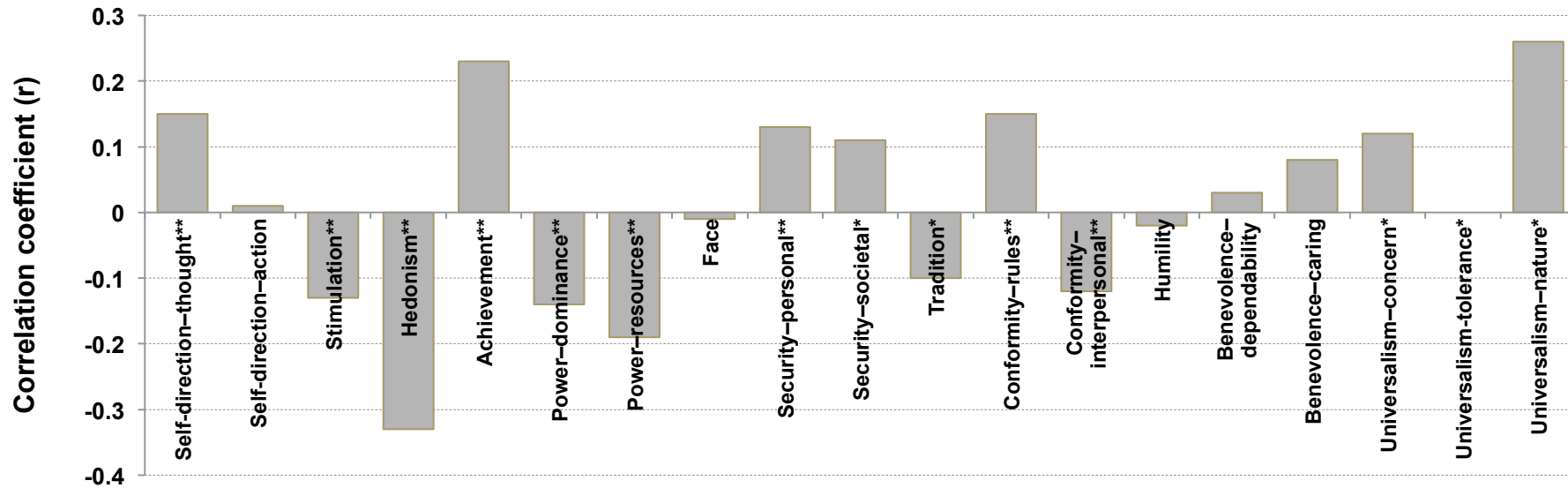
Figure 5: Strength of correlation between values and CFC. *=p<.05; **=p<.01 (two-tailed).

Table 7: Partial correlations between values and CFC, controlling for age, gender and parenthood.

	CFC-Future	CFC-Immediate	CFC-Total	Self-direction–thought	Self-direction–action	Stimulation	Hedonism	Achievement	Power–dominance	Power–resources	Face	Security–personal	Security–societal	Tradition	Conformity–rules	Conformity–interpersonal	Humility	Benevolence–dependability	Benevolence–caring	Universalism–concern	Universalism–tolerance	Universalism–nature
CFC-Future	1	-.576**	.860**	.108*	-.016	-.108*	-.324**	.189**	-.065	-.122**	.033	.144**	.081	-.066	.135**	-.138**	-.014	.016	.061	.066	-.037	.183**
CFC-Immediate	-.576**	1	-.913**	-.159**	-.027	.128**	.272**	-.223**	.162**	.212**	.041	-.100*	-.112*	.112*	-.134**	.085	.016	-.033	-.07	-.131**	-.032	-.213**
CFC-Total	.860**	-.913**	1	.154**	.009	-.133**	-.332**	.234**	-.135**	-.194**	-.009	.133**	.110*	-.104*	.151**	-.122**	-.016	.029	.075	.116*	.003	.225**

** p≤.01; * p≤.05 (two-tailed)

Table 8: Bivariate correlations between values. The theory predicts that the pattern of correlations will resemble a cosine wave.

	Self-direction–thought	Self-direction–action	Stimulation	Hedonism	Achievement	Power–dominance	Power–resources	Face	Security–personal	Security–societal	Tradition	Conformity–rules	Conformity–interpersonal	Humility	Benevolence–dependability	Benevolence–caring	Universalism–concern	Universalism-tolerance	Universalism–nature
Self-direction–thought	1																		
Self-direction–action	.46**	1																	
Stimulation	.24**	.24**	1																
Hedonism	.03	.07*	.35**	1															
Achievement	.07*	.09*	.11**	.00	1														
Power–dominance	-.03	-.02	.03	.05	.20**	1													
Power–resources	-.12**	-.08*	.06	.12**	.25**	.48**	1												
Face	-.17**	-.07	-.18**	-.14**	.11**	.05	.16**	1											
Security–personal	-.22**	-.07	-.42**	-.16**	-.01	-.10**	-.03	.14**	1										
Security–societal	-.14**	-.14**	-.27**	-.12**	-.12**	-.18**	-.11**	.02	.21**	1									
Tradition	-.34**	-.30**	-.21**	-.16**	-.05	.08*	.07*	-.05	.05	.04	1								
Conformity–rules	-.32**	-.26**	-.43**	-.31**	-.11**	-.17**	-.15**	-.06	.26**	.16**	.20**	1							
Conformity–interpersonal	-.40**	-.37**	-.25**	-.09**	-.23**	-.22**	-.09*	.16**	.07*	-.05	.03	.12**	1						
Humility	-.02	-.17**	-.17**	-.17**	-.36**	-.28**	-.37**	-.10**	-.03	-.05	.01	-.00	.18**	1					
Benevolence–dependability	-.02	-.01	-.07	-.05	-.01	-.14**	-.12**	-.09**	-.03	-.03	.01	.01	-.03	.00	1				
Benevolence–caring	-.06	-.04	-.12**	-.09**	-.11**	-.19**	-.21**	-.18**	-.01	-.01	-.03	.05	-.01	.01	.42**	1			
Universalism–concern	.14**	.09*	-.08*	-.08*	-.25**	-.36**	-.51**	-.22**	-.15**	.10**	-.29**	-.05	-.08*	.24**	-.05	.09**	1		
Universalism-tolerance	.18**	.13**	.09**	-0.05	-.22**	-.37**	-.44**	-.31**	-.19**	-.10**	-.25**	-.06	.01	.21**	.01	.08*	.44**	1	
Universalism–nature	.18**	0.03	.13**	-.08*	-.19**	-.18**	-.31**	-.16**	-.15**	-0.07	-.25**	-.18**	-.11**	.07*	-.23**	-.08*	.27**	.15**	1

** p≤.01; * p≤.05 (two-tailed)

3.6 Discussion

3.6.1 The broad view

The results fitted relatively well to our predictions from the literature (Table 6) but there were a few surprises, including the split between Conformity values, the negative relationship with Power values and the positive correlation with Self-Direction-Thought. It is interesting that only one of the two CFC subscales is implicated in five of the 13 significant correlations between CFC-Total and values, pointing to the explanatory usefulness of differentiating the scale in this way, a goal of current research efforts (Arnocky et al., 2013; Joireman et al., 2012). One feature of Schwartz' values theory is that neighbouring values are similar and compatible, and often copredict the same variables to some extent; one might normally predict that the data in Table 4 and Table 7 would form a roughly sinusoidal shape. This is one of the justifications for the common usage of four higher-order domains (Schwartz, 1992) and the biospheric/altruistic/egoistic (Stern et al., 1999) categories. Although group-focused values were more associated with CFC as predicted, three of the four higher-order domains (Conservation, Self-Enhancement and Openness-to-Change) contain conflicting predictions for CFC, and we suppose that this may be a reason why there was little relationship found between values and time orientation in two of the existing studies (Arnocky et al., 2013; Milfont & Gouveia, 2006). Furthermore, the new 19-value scale (Schwartz et al., 2012) reveals its usefulness over the 10-value model in the contrasting correlations of the Conformity values and the singling out of particular correlated facets of Self-Direction and Universalism. Based on these results and the unusually idiosyncratic pattern of correlations between values and CFC, we recommend that future work on CFC and values should not rely on only four higher-order values or the altruistic/egoistic/biospheric model.

Based on these results, we consider that the usefulness of the 19-value model has been well demonstrated. Our second aim was to generate hypotheses for further research into the antecedents of CFC. Here we interpret the correlations between values and CFC with the second aim in mind.

3.6.2 Conformity

There are a few plausible explanations for the oppositional results in Conformity values. Conformity-Rules ("Compliance with rules, laws, and formal obligations") seems to more closely match the inhibitive "order, dutifulness, and deliberation facets" of the Conscientiousness trait, which in turn predicts the old definition of Conformity (Roccas, Sagiv, Schwartz, & Knafo, 2002); no studies have yet been done linking it to the latest values model. Thus, this trait may be a confounding variable, as it also has a significant relationship with CFC (Gick, 2014).

At a more speculative level, it may be that breaking rules (e.g. laws) tends to have consequences in the long term, and following rules certainly requires us to control immediate impulses. On the other hand, conformity to group norms may be reactive, at the cost of self-directed planning.

3.6.3 Hedonism and Stimulation

Hedonism has the strongest negative relationships with CFC including both subscales. This can be best explained by the inherent tension between immediate gratification and planning for the future. Strathman et al. (1994) found a medium relationship between CFC and Najman's Deferment of Gratification Scale and it also fits with research on Dark Triad personality traits (Jonason & Tost, 2010; Kajonius et al., 2015). Stimulation is conceptually linked to Hedonism, but it may be that considering the future is not as incompatible with valuing, for example, a varied life, hence its lesser relationship.

3.6.4 Power

In keeping with what the Dark Triad would suggest, Power-Resources and Power-Dominance negatively correlate with CFC; it seems that more selfish people are significantly less considerate of future consequences. However, as Wade-Benzoni et al, (2008) successfully primed intergenerational behaviour (via increased social responsibility) using mainly Power-Dominance words (authority, boss, control, executive, influence, and rich) we offered no CFC-Total prediction for that value and predicted a positive relation with both CFC-Future and CFC-Immediate. Only the latter was significant here, suggesting that there may be a complex tension between dispositional values, power priming, CFC, social responsibility and intergenerational behaviour that seems an important area for future work.

One hypothesis compatible with both results is that prosocial intergenerational behaviour demonstrated over short intervals (e.g. minutes) does not scale up to long generational intervals (e.g. decades). In this scenario, Power-primes might increase CFC-immediate, resulting in increased prosocial attitudes and behaviour only over the short term. Another hypothesis proposed by Wade-Benzoni et al. (2008) is that feelings of dominance may activate a more intuitive moral judgment rather than reasoned argument (see, e.g. Cushman, Young, & Hauser (2006); Evans & Stanovich, (2013); Greene, Nystrom, Engell, Darley, & Cohen (2004)), a sort of "magnanimous instinct" that would presumably exclude the possibility of considering future consequences. However, in this scenario, the priming could still negatively affect other, more considered judgements about the future.

3.6.5 Achievement

Interestingly, Achievement values had the second strongest positive correlation with CFC despite being adjacent to comparatively strong anticorrelations with Hedonism and Power. Achievement is correlated with Conscientiousness (Parks-Leduc et al., 2015), specifically the facets of competence relating to achievement striving, and self-discipline (Roccas et al., 2002), and so perhaps this trait is a confounding variable. However, Achievement, like Hedonism, Stimulation and both Power values, has a stronger relationship with the Dark Triad traits (Kajonius et al., 2015) yet these traits anticorrelate with CFC and indeed also anticorrelate with Conscientiousness (Jonason & Tost, 2010; Paulhus & Williams, 2002).

There is a long-running tension in the definition of the Achievement value. Beierlein, Davidov, Schmidt, Schwartz, & Rammstedt (2012) found through confirmatory factor analysis that items used in the 10-value model could be better split into Achievement-Success and Achievement-Ambition, but Schwartz et al. (2012) did not find enough evidence to include this split in the 19-value model. The English version of the current survey assesses Achievement with the following three items: "It is important to him/her to have ambitions in life", "It is important to him/her to be very successful", "It is important to him/her that people recognize what s/he achieves". Thereof, the final item is of particular interest. It seems quite possible that an ambitious person might consider long-term consequences and delay gratification in the present (e.g. by working overtime to get a promotion), whilst not necessarily engaging with outside recognition as an end in itself. This notion is given weight by the fact that the third item was spatially distant from the other two items and close to Power in the Icelandic multidimensional scaling (Section 1: Figure 3) and in that of Schwartz et al. (2012). Further research might disentangle this, and investigate Strathman et al.'s (1994) hypothesis that socioeconomic status is related to CFC.

3.6.6 Universalism and Benevolence

Universalism-Nature correlated as predicted with CFC on both subscales, though surprisingly not nearly to as great an extent as biospheric values used by Khachatryan et al. (2013) despite the constructs' great similarities.

Nature often operates on considerably longer time scales than human affairs, and thus concern, particularly for its future, may force us to think in longer time frames. A notable exception to short-term business and policy cycles in current governance are agriculture, nature conservation and forestry sectors, the last of which very often finds itself operating on scales of centuries or more (Short & Hawe, 2012). On the other hand, in view of the on-going environmental catastrophe, it is plausible that latent concern for future consequences of our actions inspires concern for the biosphere; i.e. the relationship may easily be reciprocal.

It would be interesting to further research if valuing idealistic concepts of universal social justice (Universalism-Concern) is causally linked to less concern with immediate consequences in either direction. It is notable that Benevolence values did not show the same pattern despite having similar roots (albeit directed towards the in-group, instead of humanity more widely) suggesting that reduced CFC-I is less likely to be causing the prioritisation of pro-sociality than vice versa.

3.6.7 Self-Direction

Autonomy and CFC seem unlikely bedfellows given the latter's connection with self-control and suppression of immediate desires (Joireman et al., 2008). However, perhaps this explains why only Self-Direction-Thought shows a relationship; our actions often have consequences, but our thoughts only rarely do. Educational level is a predictor of CFC (Toepoel, 2010) and also of Self-Direction-Thought (Schwartz et al., 2012) and may be driving variations both of them, but there is unlikely to be much variation in an age-controlled student sample. Another explanation might be that autonomy of thought leads us to challenge cognitive biases, specifically 'irrational discounting' of future consequences (Lagerspetz, 1999).

3.6.8 Security

While correlations with security are small, there is an interesting split between Security-Societal and Security-Personal. While valuing the latter is associated with both lower CFC-Immediate and higher CFC-Future scores, valuing societal security isn't associated with increase in consideration of the future. Further study might reveal whether this is a consistent pattern; it may be that consequences for an abstract and complex society are more difficult to conceptualise than that for ourselves and our kin.

3.6.9 Tradition

The similarly small results for Tradition are still informative as they contrast with neighbouring values. It is perhaps surprising that there is not the reverse relationship given that Rappange et al. (2009) found that religious upbringing predicts CFC. Also, Traditionalist values, particularly related to religion, are anecdotally linked to consciously long-termist behaviour in many cultures, for example in the durability of architecture (Laugier, 1755; Tarschys, 2002), in taking time to reflect on changes and decisions, and, in Abrahamic religions and cultures, persevering in worship and ethical behaviour in pursuit of the ultimate long-term personal goal, ascent to heaven.

More empirically, Hershfield, Bang, & Weber (2014) showed that framing a nation as having a long history can be an effective way to motivate environmental behaviour, and by way of explanation quote Winston Churchill as saying "The longer you can look back, the farther you can look

forward," (p152). If Tradition values imply a greater consideration of the past, then our findings suggest this is apparently not reciprocated into the future, at least amongst Icelandic students.

3.7 Conclusion

In summary, a large amount of the variance in our consideration of future consequences can be predicted by values. There is significant potential for social benefit if we can discover any environmental factors leading to greater CFC and disentangle the causality of this relationship. Any such research should probably include personality traits as our evidence suggests that they are likely to be confounding variables. We also recommend that future studies of values use more granular values models and the CFC-14 scale, as we have here demonstrated that there is considerable nuance in the patterns of correlation between the two variables.

4 An index of intergenerational solidarity derived from national economic, social and environmental indicators

"Let them eat the future," Wendell Berry once wrote. How many of us are left, I wonder, who share with Berry the precious knowledge that the future is inedible?

- Ehrenfeld (2009), p. 61

4.1 Introduction

Humanity's discovery of long-term consequences to industrialisation has led to an unprecedented need for organised intergenerational solidarity[3]. To give the best example, climate change is characterised as a "super-wicked" problem (Lazarus, 2009; Levin, Cashore, Bernstein, & Auld, 2012) as it is not only a fiercely difficult and complex issue, but exhibits significant exacerbating circumstances that further hinder a solution. (Levin et al., 2012) name four:

1. Time is running out

2. Those who cause the problem also seek to provide a solution

3. The central authority needed to address [it] is weak or non-existent

4. Irrational discounting occurs that pushes responses into the future

Unfortunately, there is no solution at all to #1 and #2. This paper aims to contribute to the global effort to address #3 and #4.

At the personal level, irrational[4] discounting of future social benefits might happen because of short-sightedness, lack of understanding, denial, apathy, selfishness and so on (Lazarus, 2009). Discounting may sometimes also be rational, either due to uncertainties, such as the nonzero probability of human extinction or valid assumptions about the probability of technological and economic progress.

Institutions – especially governments – are often charged with overcoming self-interest and psychological biases. However, they can often be as irrational or self-interested as individual human beings, and have many additional pressures towards time discounting (short-term interests of shareholders, employees and voters; institutional momentum; competition between institutions etc.). Due to a newfound awareness of global environmental issues and the role of short-sightedness in the recent global financial crisis, the issue of long-term[5] thinking and time discounting is now being given increased attention (Oxford Martin Commission, 2013).

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[3] See §Conceptual framework for a definition
[4] Throughout, rationality is meant in the utilitarian sense of maximising social welfare. Most points also apply to personal welfare.
[5] For practical purpose, I define this as >50 years following the definition of 'intergeneration discounting' set out by (Moore et al., 2004).

However, it has long been said that the current generation discounts the future to a greater extent than those before them. We might take building lifespans as an example. Laugier (1755) is typical:

"The ancients jealous of leaving to the latest posterity traces of their abilities, spared nothing in giving to their buildings that strength which triumphs over common accidents... Our artists have now-a-days none of that great taste of solidity. They doubt if their works can sustain the assault of three centuries. They are accused even of avoiding with design to render them lasting, because they are supposed interested to renew the labour of them. It is most certain that one often sees amongst our buildings quite new ones that threaten ruin."

Obviously there is an observation bias here. More recently, sporadic attempts have been made to quantify building life (Aktas & Bilec, 2012; DPZ Pieda, 2000; Komatsu, Kato, & Yashiro, 1994) with estimated average lifespans of contemporary buildings ranging from ~30 to ~60 years. However, strategies to change this and even reliable surveys of lifespans seem to be almost non-existent, despite the vast resources used in construction. One reason may be that, as O'Connor (2004) notes, almost all buildings today are demolished for social reasons – for example changing land values, lack of exterior maintenance or changing preferences for size – rather than structural failure. Greater adaptability of design and occupancy may extend lifespans by decades or centuries.

In a small way, this example of time horizons in architecture draws attention to the information deficit we face and also the need to encourage long-term thinking and intergenerational solidarity, sometimes in areas that may not seem obvious. As a foundational step, the Oxford Martin Commission (2013) for Future Generations recently issued a call for greater measurement of the effectiveness of institutions on long-term issues, specifically an index taking inspiration from indices of governance and corruption.

Here, I propose an index that attempts to measure intergenerational solidarity using national statistical reporting. It is my hope that this can be used as a measurement proxy for this complex, intangible, yet vital concept.

4.1.1 Conceptual framework

'Intergenerational solidarity' does not yet have a standardised definition. Until the Rio+20 conference and associated work, it was mostly used outside of sustainability contexts and mainly implied that "intergenerational" meant "between old and young generations" (World Future Council, 2013). Here, as in current sustainability usage, intergenerational solidarity "goes beyond relations among the currently living representatives of different generations to embrace the future generations who do not yet exist" (United Nations, 2013). 'Solidarity' in this context can be approximated by 'intentional actions that increases or sustains wellbeing', similar to (Lopes, 2015), usually involving "sacrifices and investments" (United Nations, 2013), and has an advantage over the term 'altruism' as it allows that some investments may better the lot of current and future generations alike. 'Solidarity' also seems to imply a duty on future generations to *their* future generations. Thus, the working definition of 'intergenerational solidarity' might be "investments or sacrifices that are intended to increase or sustain the wellbeing of future generations".

This conceptualization is close to 'sustainable development', i.e. "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." (World Commission on Environment and Development, 1987, p. 41). However, it is different in some crucial aspects:

1. It is solely focused on the future. Stiglitz, Sen, & Fitoussi note (2009, p. 72) that measures of sustainable development often "effectively conflate the measurement of current well-being and the measurement of its sustainability".

2. Intergenerational solidarity is primarily focused on the temporal distribution of the components of wellbeing. Inevitably, efficient allocation and sustainable scale (see Daly, 1992) are relevant to this, but they do not define it. For example, some forms of intergenerational solidarity may be 'unsustainable' in the long run.[6]

3. Sustainable development focuses on the scale of current resource use – i.e. what current material throughput can be maintained in the long term – with a requirement that current development will essentially "do no harm" to future generations. In contrast, intergenerational solidarity is positive, making value judgements about how to invest in future wellbeing, something that could be summarised as a "greatest good" approach.[7]

4. Intergenerational solidarity therefore does not restrict itself to meeting future generations' "needs", although they may be the most important and most likely factors to influence current and future wellbeing.

4.1.2 Purposes and Criteria

In summary, the purposes of the index are:

- **To facilitate comparison.** To facilitate comparison between countries, so that patterns of success and their correlates can be investigated.

- **To allow measurement of real progress.** Most indicators of progress have short-term time horizons, yet a country should be acting in the interests of its present and future inhabitants.

- **To frame the issue.** The compositing of quite different metrics encourages holistic thinking about intergenerational solidarity and encourages debate on the trade-offs of different decisions.

- **To raise awareness.** To draw attention to intergenerational solidarity as an important issue, leading to increased planning and resource-allocation for future generations.

The criteria for selecting indicators (after Hsu, Johnson, & Lloyd, 2013; OECD, 2008) are as follows:

- **Theoretical relevance.** Indicators must have a strong conceptual relationship to intergenerational resource allocation and to human wellbeing.

- **Coverage.** The index must cover >100 national entities containing >90% of the world's population, and its range must be such able to distinguish countries in a meaningful way.

- **Comprehensiveness.** Following the common sustainability approach, the index must include indicators relating to economic, environmental and social spheres in relatively equal measure. Each metric must not have disproportionate influence over the total index. Few or no indicators should be missing for any country.

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[6] Norway's sovereign wealth fund, sustained by oil revenues, is a good example.
[7] To illustrate: it is at least theoretically possible to have a sustainable society (depending on how "needs" are defined) that shows little intergenerational solidarity. It would transfer the least amount of capital possible to the next generation without impinging on their needs through, for example, only manufacturing things to last one lifetime or investing in only in the most essential education.

- **Transparency**. There should not be too many chosen indicators and readers should be able to easily understand all of the assumptions, data sources and transformations that are used, in order to fully understand the potential uses and abuses of the index and to facilitate constructive criticism and improvements.

- **Source Quality.** Data must be sourced from respected sources that use standardised collection methods and provide open access. There is a strong preference for quantitative indicators.

- **Future-proof.** There must be an on-going commitment from source institutions to regularly update indicator data.

I have chosen to work initially at the level of the nation-state for a practical reason: reliable and comparable data simply does not yet exist for measuring intergenerational solidarity of component parts of society, such as companies, civil society organisations, individuals or governments. National figures are a blunt instrument that may show effects from all of these.

This said, it seems reasonable that national statistics may be particularly revealing of the priorities of governments, both elected and bureaucratic. Part of the duty of government is, in the implied[8] social contract that legitimates them, to work for the social good of the governed and for future generations. Many companies, individuals and civil society organisations feel no such pressure.

4.2 Method

4.2.1 Defining and operationalizing "intergenerational solidarity"

So what makes an indicator of intergenerational solidarity? Returning to the earlier definition – "investments or sacrifices that are intended to increase or sustain the wellbeing of future generations" – this can be divided into quantitative assets/infrastructure and qualitative stability of the value of those assets. The former can be well-framed by a society's "manufactured capital, human capital, natural capital, and knowledge, but also its institutions" (Dasgupta, 2001, p. 142). The latter can be framed using the concepts of *resilience*, "the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks", *adaptability*, "the capacity of actors in a system to influence resilience", and *transformability*, "the capacity to create a fundamentally new system when ecological, economic, or social (including political) conditions make the existing system untenable." (Walker, Holling, Carpenter, & Kinzig, 2004). To illustrate this by returning to the case-study of building lifespan, maximising intergenerational solidarity might mean building a sturdy, useful, low-impact structure (i.e. with high capital value) that is designed to be flexible to different uses (resilient), easily repairable and adjustable (adaptable), and might be recycled at the end of its useful life (transformable).

However, although they are highly relevant to intergenerational solidarity, these parameters are highly specific to whatever individual system they refer to, and it would be difficult to measure them on aggregate at a national level[9]. Instead, in this index they are discussed when they relate to other indicators.

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[8] And sometimes explicit – more than 40 nations reference obligations to future generations in their constitutions (Boyd, 2011, p. 311)
[9] This is not to say that they are vague, however – for example, the capacity of societies to transform might be related to evidence-based policy decisions, capture of government by special interests, path dependency in infrastructure choice etc. Aggregating this would clearly be difficult.

Measuring assets and infrastructure is significantly easier, though still fraught with complications.

First, the monetary value of current capital assets does not necessarily reflect their contribution even to current wellbeing. The flows of assets that comprise the indicators of this index are chosen based more on their theoretical contribution to wellbeing rather their dollar valuation or the importance that current society places on them.

Second, countries have differing abilities to give solidarity because of differences in present-day wealth and population. The index attempts to measure proportional solidarity, from each nation according to its ability. There will still likely be biases however - poorer nations must meet survival needs before looking after the future, something reflected in the generally high social discount rates of developing countries (Zhuang, Liang, Lin, & Guzman, 2007).

Third, I am measuring distribution between generations, but allocation between different sorts of assets is also important. I followed the sustainability concept in dividing intergenerational asset transfers into environmental, economic and social dimensions, corresponding to natural capital, economic capital and human and social capital.

Fourth, in selecting the indicators within these divisions, preference was given to those that were most pressing in a global context across many nations. For example, in the environmental dimension, forest conservation is an important indicator as it affects the carbon balance, biodiversity, long-term future of fibre industries and many other kinds of natural and economic capital. In comparison, wetland conservation, whilst an extremely important issue on a local level, applies to fewer countries and is arguably less important at a global level.

4.2.2 Similar existing work

Very little work has been done to construct national indices of intergenerational solidarity or the attitudes relevant to this behaviour. In a paper correlating cultural values and long-termist policy, Kasser (2011) used advertising to children, CO_2 emissions, parental leave and child well-being. Elsewhere, Vanhuysse (2013) used a figure of public debt per child, ecological footprint and age-based differences in poverty to compile an 'Intergeneration Justice Index', and Noguchi, Stewart, Olivola, Moat, & Preis (2014) used Google searches for future years as an indicator of national future orientation. It is indicative of the state of the literature that Vanhuysse and Kasser use a relatively ad-hoc approach to selecting their indicators and have little reference to any other existing research. Kasser's work is an example of where this index can be useful, as a standard framework for researchers in disparate fields looking to correlate their own dependent variables (cultural values in his case) with intergenerational solidarity.

In the sustainability literature, there are a vast array of composite indices (for a review of some see Singh, Murty, Gupta, & Dikshit, 2012; Stiglitz et al., 2009) but almost all do not have a specific focus on the future. One possible exception is the World Bank's Adjusted Net Savings (ANS; included in this paper; see §Economic Indicators for more details). This is probably the best-known attempt at a comprehensive economic measure of changes in assets, and even includes some measures of environmental and human capital. Unfortunately, the ethical framework it uses and the accuracy of its underlying assumptions and estimates for human and environmental capital are quite dubious (Thiry & Cassiers, 2010); the main objection is that, in common with other indicators of "weak" sustainability (Pearce & Atkinson, 1993), it is vastly over-simplistic in its assumption that all value can be adequately reduced into fungible dimensions denominated in dollars.

The Index of Economic Wellbeing (Figure 6; Osberg & Sharpe, 2002) is another typical index, but with a broader remit. Although it does not quantify everything in dollars, it follows the same approach to ANS in its 'Wealth Stocks' dimension. Its other dimensions are interesting, particularly

the 'economic security' dimension which covers some the ground of 'resilience' and related concepts, but the datasets the authors use are generally specific to a fraction of OECD countries, and therefore could not be used for a global index. As can be seen in Figure 6, its measurement of environmental concerns is strongly lacking. It also suffers from a common problem of composite indices of social constructs in that the relationship of its indicators (e.g. R&D) to its unifying concept of well-being is not always clear. Nonetheless, some of its indicators are similar to those included in this work.
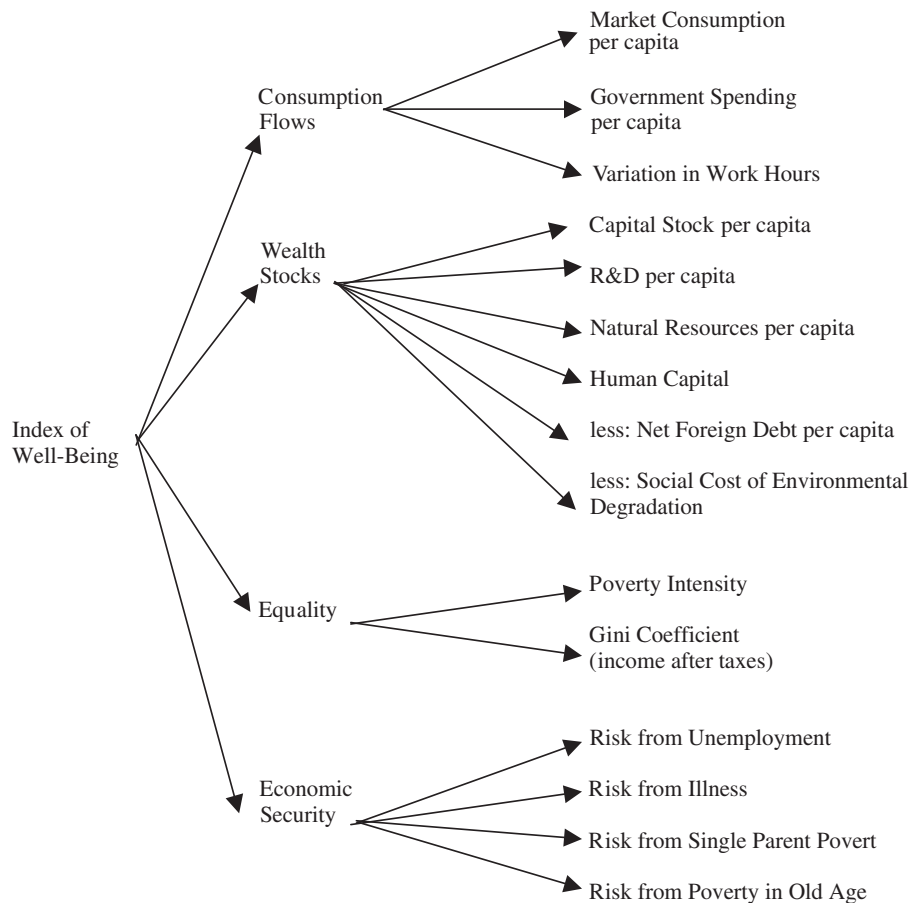

Figure 6: Index of Economic Wellbeing weighting tree (Osberg & Sharpe, 2002)

In addition, indices of environmental impacts (e.g. Hsu et al., 2014) often measure effects over the long term, but this is almost never explicit or used as the basis for weighting different components, resulting in indices combining effects on current and future generations. For instance, all pollution affects the future to some extent, but some kinds of pollution (e.g. heavy metals, radioactive isotopes) are much more of a long-term problem than those that degrade or dilute fairly swiftly (e.g. particulates, sulphates) and would thus be more relevant in an intergenerational context. CO_2-equivalent greenhouse gas indices are a notable exception, being explicitly a long-term comparative indicator; global warming potential is usually calculated over 100-year time horizons (Shine, 2009), so as to adjust the relative impacts of short-lived methane vs. long-lived carbon dioxide.

4.2.3 Selecting indicators

Each indicator was selected with reference to the index criteria laid out in the Introduction; due to the scale of the project, there was no primary data gathering. The majority of candidates were rejected on practical grounds discussed later (see Appendix V for a summary list of examples). Nine indicators were chosen in sets of three, each primarily focused on economic, environmental or social dimensions. This number allows for simplicity whilst ensuring that no one indicator had

disproportionate influence. Inevitably, all of the indicators are likely to be proxies of several kinds of capital, but were grouped according to their primary focus.

In common with other composite indices, it is crucial to remember that this index is not intended to be comprehensive or final, but rather a rough measure of intergenerational solidarity using an aggregation of some currently available metrics – in other words, an indicator itself.

4.2.4 Normalising and aggregating indicators

After selection, the indicators were normalised to a common range of 0-100. The boundaries were set based on the boundaries of the original range or on chosen benchmarks based on literature or data distribution. The goal of normalising the indicators was not necessarily to give a prescriptive target to aim for, with 100 being 'ideal'. Instead, they only define the point where the scale stops discriminating. For example, in the indicator of forest degradation, 'zero net loss' is the benchmark for 100. Net gain may or may not indicate intergenerational solidarity, but for reasons discussed later, it is here valued as equal to zero net loss. To give another example, the upper bound for pupil-teacher ratio was set at 10:1 and the bottom at 50:1 based almost entirely on data distribution; prescriptive targets for this indicator do not exist.

This method has a profound effect on how the index should be understood – scores on indicators (and thus the index) mostly only make sense in comparative terms. For instance, a low score generally means that, compared to other countries or indicators, this particular indicator is doing rather poorly and that it may need attention. Only for a few indicators (e.g. low-carbon energy production) does it relate to a hard target. As a result, the best use of the index is to get an idea of the order of policy priorities and to reveal high-performing countries that might inspire policy in others.

Some indicators were normalised for population or GDP or transformed to give greater weight to relatively small differences or to cluster extreme differences. The standard equation used was:

$$100 \left(\frac{Observed\ value - minimum}{Target - minimum} \right)$$

which is a variant of that used in the Environmental Performance Index (Hsu et al., 2013) and the Human Development Index (UNDP, 2014). The method section for each indicator gives details of any deviation from this.

Most indicators averaged the most recent available data (following the method of Vanhuysse, 2013), over the most recent 5 years, a range which is a common medium-term policy timeframe used in many countries (e.g. the election cycle and the five-year plan, Brender & Drazen, 2005; Lu, Stegman, & Cai, 2013) and diminishes the significance of single-year fluctuations. Future iterations of the index should use improved data coverage to standardise this period as much as possible as it may be a source of inconsistency. Countries were not excluded if some years used in the average were missing, trading a degree of precision for a much greater diversity of indicators and much broader coverage.

To derive the index, I gave equal weighting to all indicators and aggregated them geometrically following the method of the Human Development Index (UNDP, 2014). Equal weighting is common in composite indices (Böhringer & Jochem, 2007) particularly in the absence of clear theory on the 'importance' or substitutability of indicators, but should be noted as a significant assumption.

Geometric aggregation takes the following form, with indicator scores represented by i and the number of indicators n:

$$(i_1 \times i_2 \ ... \times i_n)^{\frac{1}{n}}$$

Geometric aggregation, while more difficult to communicate than linear aggregation, partially rectifies the problem of different indicators being substitutable (Hsu et al., 2013) as it disproportionately magnifies small changes at the low end of the scale. For this reason it is particularly well-suited to indices aggregating radically different dimensions (OECD, 2008; UNDP, 2010). It ensures that high scores in the index should reflect a high score in most of the indicators, rather than particular excellence in a few areas, and low scores will significantly affect a country's total score (Böhringer & Jochem, 2007; Ebert & Welsch, 2004). It also means that, while weighting is less important, greater attention should be paid to the assumptions behind benchmarks and transformations. For instance, it has the effect of giving very low scores something akin to a threshold effect on the final outcome – even if eight indicators score 100, if the last scores zero[10] then the index will only give a total score of 60.

To reiterate, because a country has a high score in the index does not mean that it satisfies a particular target for 'intergenerational solidarity'. Even if it this could be measured in a single dimension, it would be impossible to set a target. What a higher score indicates is simply that, compared to other countries, a nation performs above average in most or all of the chosen indicators. Therefore, in some sense, the index can also be thought of as a hybrid of a rank order composite (e.g. Pereira, 2013) and sustainability indices that are made up of indicators scaled to more specific, theory-based definitions of 'sustainable' (e.g. Hsu et al., 2014).

There is a long-running debate in sustainability literature about the usefulness and dangers inherent in aggregating indicators (OECD, 2008). I decided to aggregate for the following reasons:

1. Intergenerational solidarity, defined as capital transfer to future generations, only has meaning in terms of an aggregate of its component parts.

2. The wellbeing of future generations seems likely to increase from some kinds of capital substitution in their inheritance, so the index score is as important than the individual indicators.

3. This index is not designed to predict or measure non-linear effects such as ecological collapse or economic risk, nor is it designed to be comprehensive; the intent is to highlight comparisons between indicators and countries. As Stiglitz et al. put it, "composite indicators are better regarded as invitations to look more closely at the various components that underlie them" (2009, p.65)

4. Target selection means that a score of 100 in many indicators is close to "strong" sustainability (maintenance or increase of all asset stocks)

5. Geometric aggregation means that perfect substitution is not assumed and that very low scores in one indicator are not masked by high scores in others.

6. Communication to a non-technical audience is core to the purposes of this index and the advantages of aggregating are considerable in that regard, particularly for policymakers (Dalal-Clayton & Bass, 2002, p. 138)

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[10] All null values were aggregated using a value of 1 as is necessary for geometric aggregation to function

In addition to the factors relating to system stability discussed previously, many important assets that might be included in intergenerational solidarity are not currently measured; this is discussed further in the headings for each dimension. It is quite possible (although hopefully unlikely, if the index is well-constructed) that a nation could have a perfect score and still be failing future generations in some very significant way (e.g. through mass soil loss, not currently included). As datasets improve, other indicators should be added to the index.

After aggregation, I calculated bivariate correlations of indicator scores with each other and with population size, population density and GDP. The latter three seem likely to be confounding variables and may help explain patterns in the results.

4.3 Environmental Indicators

At the present time, the pressing environmental issues for future generations are that current generations curtail pollution, biodiversity loss and ecosystem degradation and ensure that renewable and non-renewable resources are used with an eye to limits. Of these, greenhouse gas pollution, soil degradation, biodiversity loss and nutrient pollution appear to be the issues with greatest cause for global alarm (Bindraban et al., 2012; Steffen et al., 2015). Unfortunately, there are no good direct or indirect global indicators for any of these apart from greenhouse gas emissions, as they are frustratingly difficult to measure (Conijn, Bai, Bindraban, & Rutgers, 2013; Mendenhall, Daily, & Ehrlich, 2012; Srebotnjak, Carr, De Sherbinin, & Rickwood, 2012). However, the three indicators chosen for the index, forest degradation, carbon footprint and low-carbon energy use, can be considered proxies for soil degradation and biodiversity loss inasmuch as these are exacerbated by climate change (Nearing, Pruski, & O'Neal, 2004; Thomas et al., 2004) or are linked to high consumption or forest habitat loss. Biodiversity and soil loss is also directly related to deforestation in some cases, notably in the tropics (Maina et al., 2013; Mendenhall et al., 2012; Siikamäki & Newbold, 2012). In future, a wider range of indicators would be greatly preferred.

More technically, forest degradation is the only indicator with missing data for some countries, due to lack of significant forest cover. To compensate, in these instances I increased the contribution from the other two environmental indicators to the index from 1/9 to 1/6, in order to preserve equality of contribution from each of the three dimensions.

4.3.1 Environmental Indicator: Net forest degradation

Table 9: Equation, definition and data source for net forest degradation indicator.

Metric	0	100	Equation[11]	Time period	Source
Net change in forest with >50% canopy cover	≤-10%	≥0%	$100 \dfrac{x-(-10)}{0-(-10)}$	12-year average (2000-2012)	Hansen et al. (2013a)

4.3.1.1 The indicator

Satellite data for forest cover in 30m^2 blocks was used (Hansen et al., 2013b) due to the much greater accuracy of that database over U.N. Food and Agriculture Organisation data (2014), which is based on dubious and subjective national self-reports amongst many other limitations (see Hansen et al., 2013a, for details). A twelve-year average was used based on the limited data

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[11] Equations are unsimplified for explanatory clarity. Here, -10 is the scale minimum, and 0 is the maximum.

currently published, to which the authors have guaranteed regular updates. Only forest of >50% canopy was used due to limitations on forest gain data, and 19 countries with <200km^2 of this were excluded, following the method of the Environmental Performance Index (Hsu et al., 2014). This means that this is a measure of canopy density degradation from full or nearly-full canopy to below 50% cover. 10% annual loss was used as a lower benchmark as the worst performer's loss rate of 16.8% was comparatively extreme (Figure 7) and caused clumping of other nations' index scores. Zero net loss was the upper benchmark as the afforestation of some nations above the cut-off (e.g. Uruguay, with 22% growth in area) is ecologically questionable (Geary, 2001) and so not necessarily better than maintaining forest cover. Only 10 of 120 included nations achieved zero net loss over the time period.
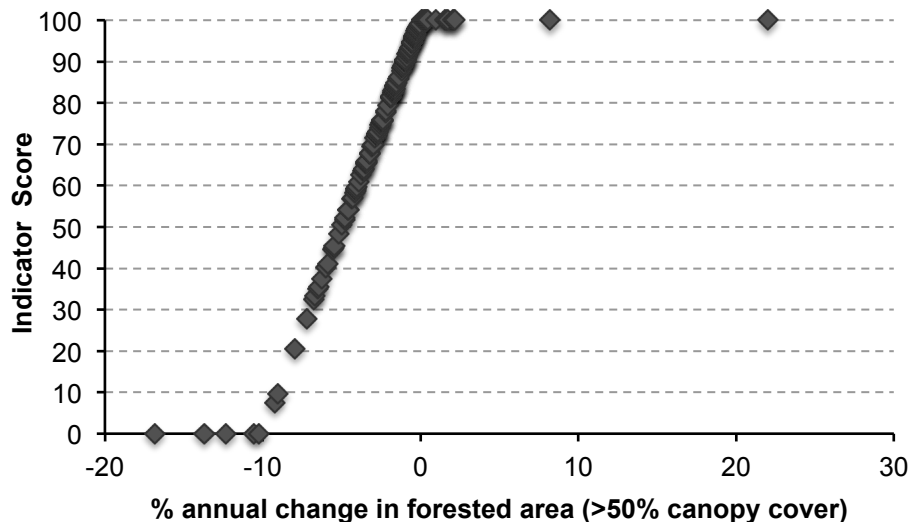

Figure 7: Relationship between forest degradation indicator scores and annual forest loss. Points from real-world dataset used in the indicator.

4.3.1.2 Theoretical basis

Maintaining forestry is inherently a long-termist enterprise, whether it is by preservation or active plantation. Trees have maturing cycles of many decades, forcing foresters to think and act in long-term cycles for the benefit of people that they may never meet, sometimes in the face of great uncertainty. For example, in an extraordinary continuous act of intergenerational solidarity, peasant coppice foresters in 2nd-millenium European countries would often rotate coppice-with-standards on regular cycles of 30 years for the coppice understory, and up to 160 years for the overstory that grew above them (Short & Hawe, 2012).

Although this makes forest conservation an excellent barometer of long-termism, obviously there aren't equal opportunities for forestry in every country. Climate and soil differences, as the Icelandic colonists found out to their cost, may mean that natural regeneration is much slower or that deforestation leads to soil loss and an ecologically stable, treeless state (McGovern et al., 2007). On the other hand, economics may lead to agricultural abandonment and the natural advance of forests, as in New England, USA (Jeon, Olofsson, & Woodcock, 2014).

Also, there are many complex value-judgements around the *kind* of forest that our descendants will want: would they prefer diverse old-growth forest ecosystems, or relatively barren reforested Sitka spruce plantation as in most of Europe (Magura, Elek, & Tóthmérész, 2002)? Would they prefer afforested *Eucalyptus* plantations, or a native savannah as in Uruguay (Geary, 2001)? Or would they prefer an ecologically-sensitive agroforestry regime to any of these, something which would be classed as "degraded forest" under the definition of this indicator?

Lastly, trees do not just fall to chainsaws – they are also affected by storms, climate change, fire, disease, drought and a number of other factors (Le, Smith, Herbohn, & Harrison, 2012) – and so short-termist exploitation is not to blame for all kinds of forest degradation. Notable recent instances of this are Sweden (4.1% net loss), stemming partly from a strong cyclone in 2005 (Valinger & Fridman, 2011), and Canada (3.7% loss), where entire forests in the West have been wiped out by a severe plague of mountain pine bark beetles linked to climate (Kurz et al., 2008). On the other hand, it is quite clear that humans are driving the degradation in Indonesia (5.5% annual net loss), Paraguay (16.8%), Cambodia (13.7%) and many other countries (Hansen et al., 2013a) and these caveats are not strong enough to bar it from being a useful indicator.

4.3.1.3 Future Directions

Some countries are reducing degradation rate substantially – for example, Brazil's loss in 2011 was over two thirds less than the 1996-2005 average by one measure (Boucher, Roquemore, & Fitzhugh, 2011). When annual data is available, it may be better to look at a predicted long-term trend in degradation rate, over five or 10 years. It may be possible to disaggregate logging from the natural causes of degradation discussed above. Also, once satellite data on forest gain of <50% canopy cover exists, it may be preferable to differentiate clear-felling from degradation. Lastly, the indicator should be standardised to a 5-year average when further data becomes available.

4.3.2 Environmental Indicator: Carbon footprint (Consumption-based)

Table 10: Equation, definition and data source for consumption-based carbon footprint indicator.

Metric	0	100	Equation	Time period	Source
Carbon Footprint component of Ecological Footprint	Undefined	≤ 0.6 Global hectares per capita (Gha/c)	$100 \cdot \dfrac{0.6}{x}$	2011	(Global Footprint Network, 2015)

4.3.2.1 The indicator

Ecological footprint is one of the most widely-used indices of human impact on the environment, measuring "the amount of biologically productive land and water area an individual, a city, a country, a region, or all of humanity uses to produce the resources it consumes and to absorb the waste it generates" (Kitzes & Wackernagel, 2009, p. 813). There are several criticisms of its methodology (see (Ayres, 2000; Fiala, 2008) for the most pertinent), but it has improved significantly in recent years and continues to evolve (Kitzes et al., 2009). All data come from the 2011 dataset except for Iceland's, which was estimated to be the same as Norway's due to similarities in consumption patterns, consumer imports and renewable energy production.

The world's average carbon footprint was estimated to be 1.4 global hectares per capita (Gha/c) in 2009, and average ecological footprint 2.6Gha/c. The world's biocapacity was estimated at 1.8Gha/c. Assuming that most of this 0.8Gha/c shortfall must come from carbon emissions, the target should be 0.6Gha/c. This is consistent with the data: Algeria, Ecuador, Guatemala and Jamaica all have ecological footprints of 1.8Gha/c and have carbon emissions of 0.5-0.8Gha/c.

The non-carbon components – fishing grounds, fibre forests, grazing, cropland and built-up land – may also be reduced to some extent. However, cropland takes the lion's share of this (0.6Gha/c) and seems unlikely to diminish in extent given historical and predicted trends in population and consumption growth (Huber, Neher, Bodirsky, Höfner, & Schellnhuber, 2014). There may also be a

seesaw effect. For instance it could be that carbon footprint reductions will require an increase in fibre production to make up for carbon-intensive cement.

It should also be noted that this per-capita target will shift downwards as world population increases and that it takes no account of any greenhouse gas apart from CO_2, although it seems reasonable that patterns of consumption-based CO_2 emissions will be similar to those of other gases.

To furnish the rest of the scale, a simple reciprocal transformation was used. This means that doubling footprint halves the indicator value – i.e. 1.2 Gha/c = 50, and 2.4 Gha = 25 – thus giving a boost to countries relatively near 0.6 Gha/c and a handicap to those far away from it.
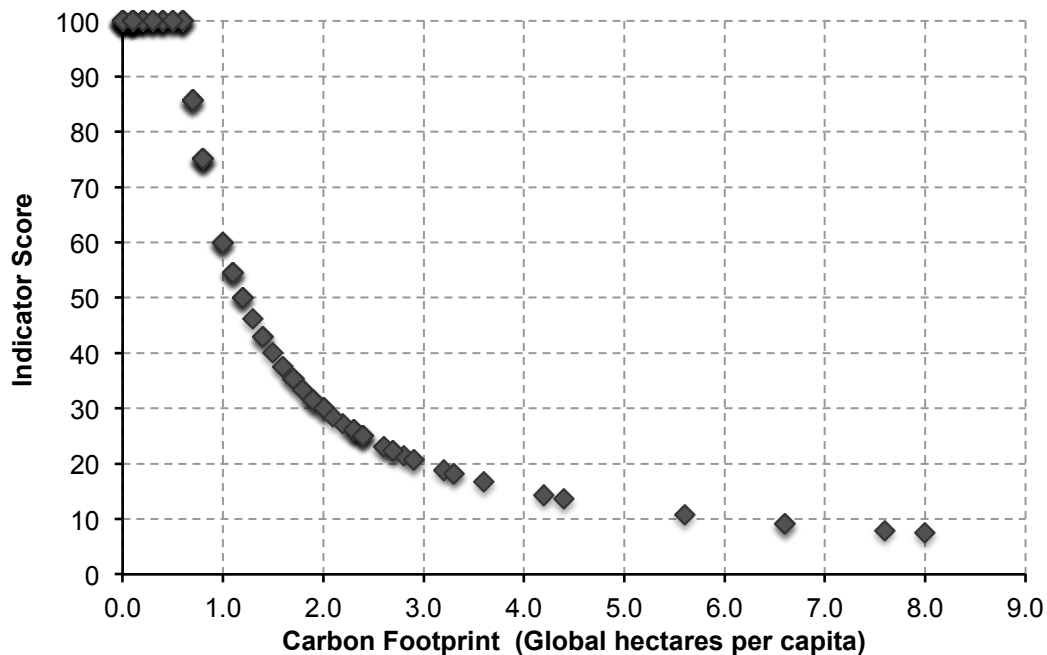

Figure 8: Relationship between carbon footprint indicator scores and annual forest loss.

4.3.2.2 Theoretical Basis

There is straight-forward long-term element to carbon emissions; the benefits are (mostly) frontloaded and the effects of atmospheric CO_2 are backloaded over timescales of tens, hundreds and thousands of years (Solomon et al., 2009). It seems sensible to single it out too – it better indicates unsustainability as it is the only part of the Ecological Footprint where deficits can be delayed over time; i.e. the sum of all of the other components cannot by definition exceed the earth's biocapacity. There is a general consensus amongst reviewers that this fact and also particular technical points in its method of aggregation mean that it is more useful than the wider ecological footprint measure (Stiglitz et al., 2009, p. 71,80).

As mentioned previously, emissions of CO_2-equivalent (CO_2e) over a 100-year time scale is a rare example of a long-term indicator with currency in today's politics. However, the fact that this measures production of CO_2e rather than embodied consumption is a significant disadvantage, benefitting rich import-based economies at the expense of poorer export-based economies (S. J. Davis & Caldeira, 2010). If we consider CO_2 emissions as approximating the affluence/consumption and technology/efficiency components of the well-known I=f(P,A,T) equation (as modified by (Alcott, 2010)), the carbon footprint approach assigns responsibility for emissions to already-affluent consumer countries, implying they have the duty to either reduce consumption or increase demand for efficiency in producer countries. The alternative would be to

give responsibility to producer countries to unilaterally impoverish themselves further by reducing supply or spending on uneconomic efficiency.

However, it seems likely that for most countries at the current time, low per-capita CO_2 emissions are not due to intergenerational solidarity but rather a sign of poverty (Figure 9). There are some notable exceptions (e.g. Norway, with its high levels of renewable electricity, albeit fossil-fuel driven GDP) and as more countries reduce their footprints over the coming decades, this bias might be expected to become less strong. However, as it records arguably the most long-term and important effects of the behaviour of current generations, the indicator remains an important constituent measure of intergenerational solidarity.
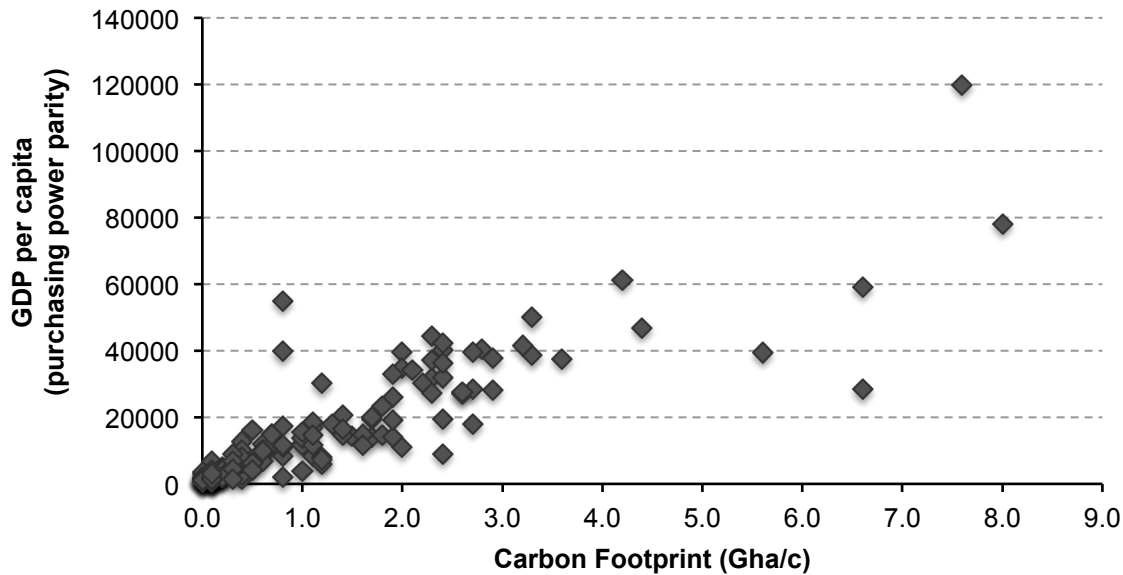

Figure 9: GDP and Carbon Footprint (2011 data).

4.3.2.3 Future Directions

It might be argued that this indicator should be corrected for GDP. In particular, a "carbon intensity" (S. J. Davis & Caldeira, 2010) correction of the following form was considered:

$$100 \cdot \frac{0.6}{x} \cdot G$$

where G is GDP/c and current footprint (*x*) was set at a minimum of 0.6Gha/c to emphasise the need for economic development. This formula would, in a very rough way[12], measure how much GDP is generated within the quota of 0.6Gha/c and rank countries accordingly. However, this is not currently used as it is more difficult than carbon footprint to understand intuitively, focuses on production rather than changes in wealth, and relies on a larger number of assumptions of questionable accuracy and precision.

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[12] Assuming e.g. linear relationship between GDP and carbon footprint

4.3.3 Environmental Indicator: Low-carbon energy generation.

Table 11: Equation, definition and data source for low-carbon energy use indicator.

Metric	0	100	Equation	Time period	Source
Low-CO$_2$ energy generation as % of total consumption.	=0%	=100%	$100\sqrt{\dfrac{x-0}{100-0}}$	5-year Average (2007-2011)	International Energy Agency (IEA, 2015a) and U.S Energy Information Administration (US EIA, 2014)[13]

4.3.3.1 The indicator

This indicator measures energy use from minimal-CO$_2$ energy sources such as geothermal, hydroelectric, nuclear, wind and solar. Due to source data limitations and theoretical uncertainty it excludes biofuels such as sugarcane or corn ethanol. It also excludes all hydrocarbon fossil fuels. A square-root transformation (Figure 10) was applied for reasons explored below.
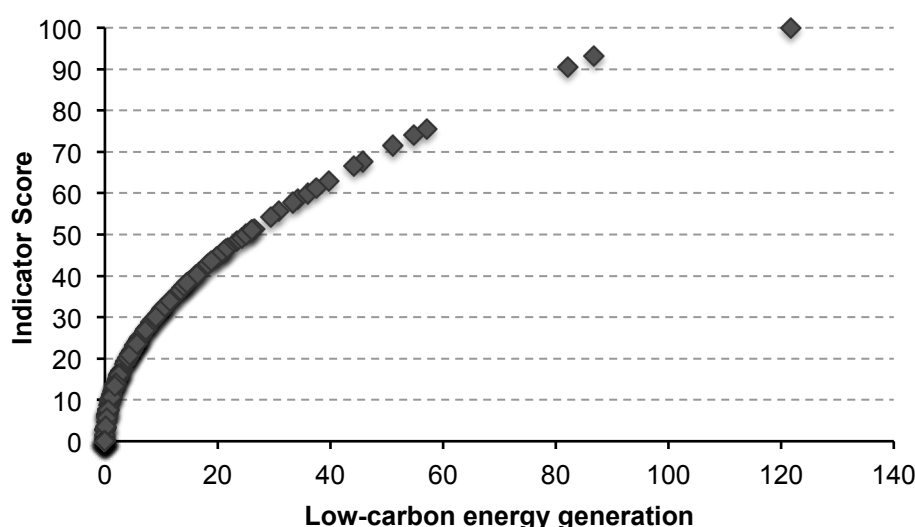

Figure 10: Relationship between low-carbon energy generation indicator scores and low-carbon energy generation, including for export.

4.3.3.2 Theoretical basis

Fossil fuel use makes up a large part of most nations' CO$_2$e emissions (e.g. c.79% for the USA in 2013; U.S. Environmental Protection Agency, 2015), and the high cost and long lifetimes of its associated infrastructure entails formidable path dependency for energy planning. Given the urgent need for drastic decarbonisation of energy generation, current low-carbon energy generation improves the wellbeing of future generations not only through emitting less CO$_2$, but also through not deferring the cost of investing in low-carbon infrastructure and maximising the lifespan of current infrastructure.

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[13] For Malawi, Uganda, Madagascar, Laos, Paraguay, Niger, Burkina Faso, Mali, Rwanda, Guinea, Burundi, Liberia.

Although it is not a renewable resource, including nuclear energy to electricity generation adds a particularly long-term component to this indicator. Much has been said about long-term planning of nuclear waste disposal or lack thereof, but nuclear energy remains one of the most long-term-oriented enterprises that modern industrial civilisation undertakes. A full life cycle may be planned 100 years in advance, and post-decommissioning projects aimed at containing spent fuel are forced to account for radioactive isotopes with half-lives of millennia. For example, the Onkalo deep geological repository in Finland is midway through an 80-year design, operation and decommissioning cycle (Kojo, Kari, & Litmanen, 2010). When it is sealed in 2050, it will be expected to safely store nuclear waste for ten millennia (Nummi et al., 2012, p. 38).

It should be noted that in many cases a high share of low-carbon energy use is arguably due to a combination of easy availability of hydroelectric dam sites and low populations rather than long-term planning. Particular examples of this are Norway, Paraguay, Iceland (also with geothermal usage) and Tajikistan. To reduce the arbitrariness of these very high scores, and also to elevate the lower scores of countries that have only recently begun to invest heavily in renewable energy, a square root transformation was applied.

4.3.3.3   Future Directions

As more countries invest in distributed low-carbon energy infrastructure, it may be possible to forecast energy mixes. At the moment this is not possible, due to the large variations caused by the commissioning or decommissioning of centralised nuclear or hydroelectric plants. In addition, an assessment of the sustainability of biofuels and household waste might significantly improve the accuracy of the indicator in some countries e.g. Brazil, where 22.9% of energy consumption in 2012 came from biofuels (IEA, 2015b). This might be extended to the footprints of non-carbohydrate energy sources, including for example the titanic quantities of cement used in some hydroelectric dams, and could also incorporate CO_2e emissions to account for methane release in dam reservoirs. Currently however there is too much uncertainty about lifecycle analyses of both this and biofuels for them to be taken into account (Johnson, 2009; Liska et al., 2014; Melillo et al., 2009).

The indicator should also change as information and technology changes. For example, it might be corrected for carbon capture and storage technologies if they become a significant part of national carbon budgeting. In addition, there is currently great uncertainty about global uranium resources due to lack of exploration. Known reserves are predicted to last around 35 years given assumptions about growth in capacity, unknown resources seem likely to significantly increase this figure and current research into technology of extraction and use suggests that its viable economic lifetime could be extended from hundreds to thousands of years (Brook, 2012; Gabriel, Baschwitz, Mathonnière, Fizaine, & Eleouet, 2013). However, if 'peak uranium' can be shown to be a near-future issue, then nuclear power should be dropped from the definition of this indicator.

4.4 Economic Indicators

It is easy to argue that changes in a nation's wealth are critical indicators of future welfare, yet current policy is focused on optimising production, with little regard to the usefulness or lifespan of what is produced, or the distribution or loss of wealth (Stiglitz et al., 2009). Here I include the adjusted annual amount of wealth saved, the sustainability of current investment, and the distribution of wealth. Although none of these indicators measure wealth transfers on a specifically intergenerational scale, I assume that they will be indicative of it.

Of the indicators that I examined and did not include, the government social discount rate used in calculating cost-benefit analyses seems like the most unfortunate omission. Despite its importance to intergenerational projects and particularly to climate change mitigation and adaptation, many countries have no set social discount rate or different rates between departments, and there is no

centralised database of figures (Zhuang et al., 2007). Currently, its use is often worryingly arbitrary; (Moore, Boardman, Vining, Weimer, & Greenberg, 2004) memorably characterise policymakers as demanding that economists "just give me a number!".

4.4.1 Economic Indicator: Adjusted Net Savings

Table 12: Equation, definition and data source for Adjusted Net Savings indicator.

Metric	0	100	Equation	Time period	Source
% of GNI, 5-year average	≤0%	≥20%	$100\left(\dfrac{x-0}{20-0}\right)$	5-year average (2008-2012)	World Bank, (2015)

4.4.1.1 The indicator

Adjusted Net Savings (previously also known as "Genuine Savings", abbreviated ANS) is produced by the World Bank in an attempt at a catch-all indicator for 'sustainable investment'. It is calculated by taking figures for gross savings (itself made up of gross capital formation, net capital inflows and changes in foreign reserves) and subtracting estimated resource depletion, emissions damages from particulates and CO_2, and consumption of fixed capital, and adding public spending on education (Figure 11). The World Bank calls it an indicator of a broadly-defined "weak sustainability" (Bolt, Matete, & Clemens, 2002) that assumes substitutability of different kinds of capital.

Adjusted Net Savings is currently the most comprehensive dollar-equivalent index of changes in capital, covering 173 nations and groupings. It is widely-known and has been praised by economists as a significant improvement on GDP as an indicator for policy decisions. To convert it to an indicator, we normalised it in the range 0-20% of GNI (Figure 12).
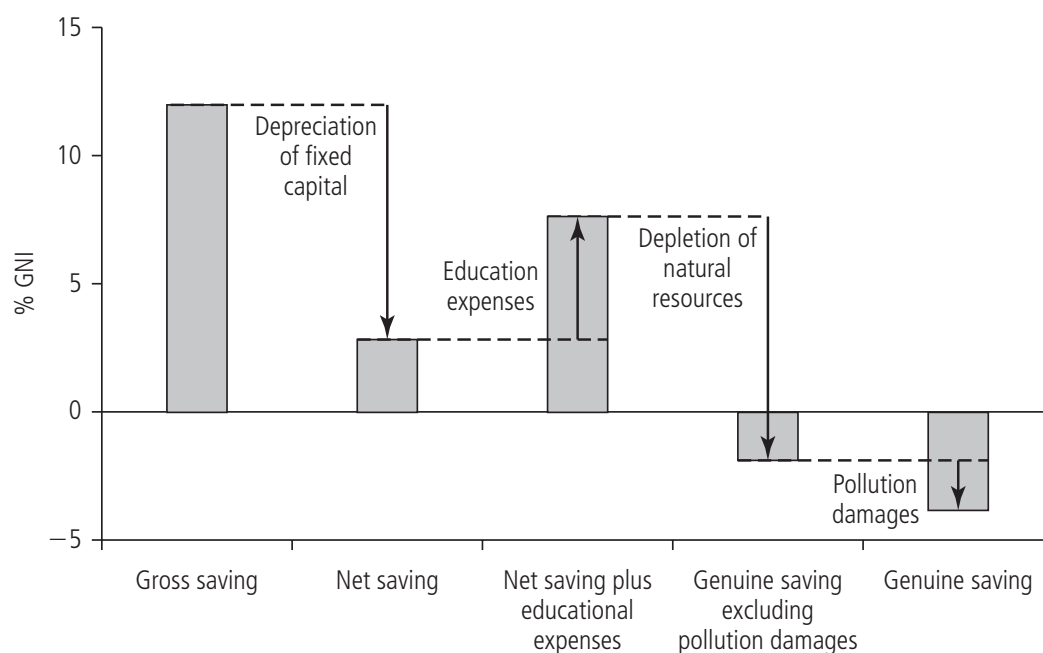

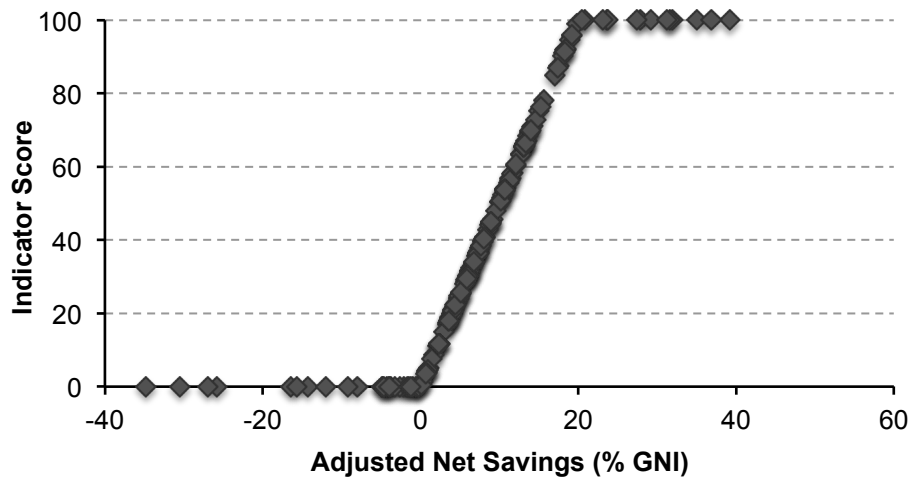*Figure 11: Calculating Adjusted Net Savings (World Bank, 2006).*

Figure 12: Relationship between ANS indicator score and ANS.

4.4.1.2 Theoretical basis

That Adjusted Net Savings is a constituent measure of the wellbeing of future generations is almost tautological, as it attempts to measure deferred consumption. Certainly it improves on a raw value of capital formation or gross savings. The main question is *how well* it does this.

Despite its clear usefulness, Adjusted Net Savings has been robustly criticised (see (Pillarisetti, 2005; Thiry & Cassiers, 2010) for summaries). To give a few examples, from the abstract to the concrete: it is rooted in a utilitarian framework, thus measuring only productive capital instead of wealth (broadly defined as "anything that has value"); its assumption of the substitutability of e.g. human capital (education) and natural capital (resources) is gravely mistaken; it places all blame on resource consumption with exporting nations; it prices resource consumption and environmental degradation based only on current market value rather than any biophysical considerations; and its makeup is self-admittedly "chosen mostly for its parsimonious data requirements" rather than through any theoretical basis (Bolt et al., 2002), thus leaving out fisheries, biodiversity loss and soil degradation amongst other factors (Stiglitz et al., 2009, p. 69). It also seems to have only a weak relationship to other indicators that should be proxies for the wellbeing of future generations, e.g. infant mortality and Human Development Index (Gnègnè, 2009). Upon consideration it seems wisest to take it, with caveats, as an acceptable indicator of savings or consumption of solely economic assets. This is also the explicit recommendation of (Stiglitz et al., 2009); we should not forget John Ruskin's caution that "that which seems to be wealth may in verity be only the gilded index of far reaching ruin" (Ruskin, 1872, p. 52).

4.4.1.3 Future Directions

It may be that Adjusted Net Savings improves in methodology as we gain more precise methods for estimating natural and human capital. However, its underlying assumptions about economic valuation (e.g. demand-based pricing) seem unlikely to change and therefore its place as an indicator of solely economic wealth is unlikely to change. There may be better indices relating to capital formation, or perhaps even wealth, in the future. The Inclusive Wealth Index (UNU-IHDP & UNEP, 2014) is the most prominent current candidate, but it is still in early stages and has grievous unresolved difficulties of its own, such as its attempt to include an economic valuation of human life proportionate to GDP. Amongst a number of obscene consequences that illustrate the problems of economic capital valuation, it concludes that a European's life is worth several times that of an African's.

Arguably, Adjusted Net Savings could also be adjusted progressively for income, although I chose not to do this for simplicity.

4.4.2 Economic Indicator: Current Account Balance

Table 13: Equation, definition and data source for current account balance indicator.

Metric	0	100	Equation	Time period	Source
Current account balance (% of GDP)	≤-10%	≥0%	$100\left(\dfrac{x-(-10)}{0-(-10)}\right)$	5-year average (2009-2013)	International Monetary Fund (IMF, 2015)

4.4.2.1 The indicator

The current account is part of a country's balance of payments, and quantifies flows of goods and services in and out of a national economy, as well as investment income and unreciprocated transfers (e.g. international aid and remittances). The other part of the balance of payments is the capital and financial account, which records asset transfers, capital transfers and financial transactions. In keeping with the theory of double-entry bookkeeping, the two should be equal – in practice there may be significant discrepancies – and thus a shortfall in the current account must be met by selling assets or foreign borrowing. In standard economic theory, current account balance is also equivalent to savings minus investment (Tucker, 2011). Cut-offs were based on theoretic concerns as described below, and no transformation was applied (Figure 13).
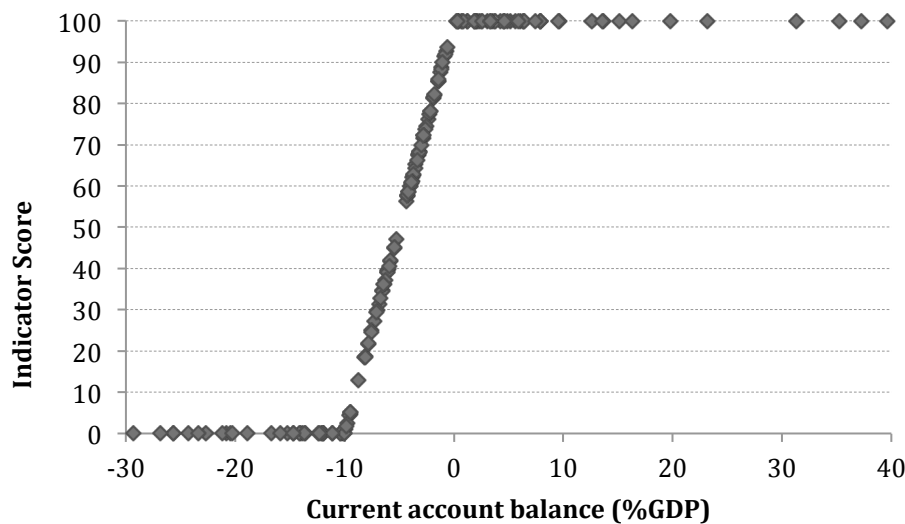

Figure 13: Relationship between current account balance indicator scores and current account balance.

4.4.2.2 Theoretical basis

Current account deficits directly affect capital transfer to future generations. Today's deficits (i.e. unsustainable imports/investment) imply future surpluses financed by exports and higher savings or lower investment (Olivei, 2000); another description of these patterns is 'intertemporal trade' (Corden, 2011; Leimbach & Baumstark, 2011). The matching capital account surplus essentially

means borrowing through various methods from other countries, debt that future generations will have to service and repay.

Some classic examples of national crises predicted by a large current account deficit are: the 1991 Indian crisis; the 1997 Asian crisis (Radelet & Sachs, 1998); the 2008 Icelandic crisis (Obstfeld, 2012); the 1999-2002 Argentinian crisis (Bussière, 2007), the 1994 Mexican crisis (Blecker & Ibarra, 2013) and arguably the ongoing crisis in much of the Eurozone (Krugman, 2014) or even the 2008 global financial crisis (Corden, 2011).

A deficit is not necessarily bad if the benefits of immediate liquidity outweigh the costs of incurring debt or selling assets (Blanchard & Milesi-Ferretti, 2012). Indeed, this may be why some countries, such as Australia, New Zealand and the USA have been able to maintain deficits for decades – but even "good" deficits mean borrowing against future income and are risky (Obstfeld, 2012), potentially making whole economies less resilient. For example, high borrowing at low interest rates for capital investment in a developing economy may eventually correct the associated short-term current account imbalance through growth in exports, and thus be "good", but as many African nations have found to their cost, such capital projects can lead to generations of national problems if they are unsuitable, badly planned, or fail. In wealthier countries, such as many of those listed above, the primary risk comes from capital flight as a result of overinflated asset bubbles or other losses of confidence in a national economy (Edwards, 2004).

While there is a consensus that significant current account deficits are 'bad' because they imply instability (Boljanović, 2012; Edwards, 2004), there are many factors contributing to a deficit and so it is difficult to be precise in giving a range to this indicator. However, the upper bound of 0% can be justified as any deficit implies an intertemporal trade-off, and the lower bound of -10% of GDP can be justified by risk, looking at predecessors to the crises listed above and other factors, such as the economic performance of countries in the Eurozone in the last 10 years (Backus, Henriksen, Lambert, & Telmer, 2009; Blanchard & Milesi-Ferretti, 2012; Blanchard, 2007; Brissimis, Hondroyiannis, Papazoglou, Tsaveas, & Vasardani, 2012; Herwartz & Siedenburg, 2007; Milesi-Ferretti, Maria, & Razin, 1996; Radelet & Sachs, 1998). For example, immediately before their crash, the Asian economies had deficits of between 2% and 8% (Radelet & Sachs, 1998), and a 5% current account deficit is generally considered to be problematic (Boljanović, 2012). If a country's deficit is sustained at more than 10%, then this is unambiguously a large problem for future generations, and probably current generations too.

As with the indicator of forest degradation, the upper bound of is not higher than 0% because of the argument that current account surpluses, while often good for future wellbeing in individual nations, may also be damaging (Blanchard & Milesi-Ferretti, 2012), especially to other countries. Lord Keynes notably proposed an international clearing union at the Bretton Woods conference in 1944 which would regulate international current account surpluses (more so than deficits) and specifically try to prevent the kind of capital flight that has destabilised the economies of so many countries (Crotty, 1983).

This proposal did not gain acceptance, but criticism of surpluses are still common. For example, Germany has faced wide criticism for running a high surplus within the Eurozone (Young & Semmler, 2011). However, temporary surpluses can also play a helpful role in smoothing exports in countries dependent on the prices of a few commodities (Bems & de Carvalho Filho, 2011).

4.4.2.3 Future Directions

A more refined metric might disaggregate the causes of current account deficits, which can determine to a great extent whether they causes crises (Milesi-Ferretti et al., 1996). It might also

penalise countries, particularly those with above-average GDP, which have excessive surpluses in the long term without a good cause.

4.4.3 Economic Indicator: Wealth Inequality

Table 14: Equation, definition and data source for wealth inequality indicator.

Metric	0	100	Equation	Time period	Source
Gini coefficient of wealth inequality	=1	= 0	$$100 - 100\left(\frac{(x-1)+1}{0-1}\right)^2$$	2014	Stierli, Shorrocks, Davies, Lluberas, & Koutsoukis (2014)

4.4.3.1 The indicator

The Gini coefficient has been used for over a hundred years as a measure of unequal distribution of any attribute (Figure 14), but is perhaps best known for its applications to wealth and income (Ceriani & Verme, 2012). National wealth data including wealth's Gini coefficient are not collected by any intergovernmental agency with coverage larger than the OECD, but are currently estimated annually by Crédit Suisse.
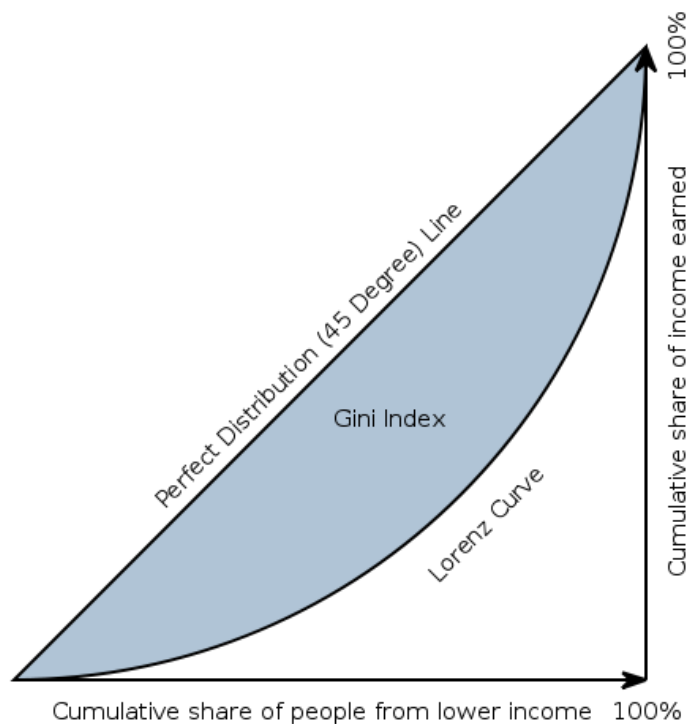
Figure 14: How the Gini Index is calculated. The Gini Index is the share of the blue shading with respect to the total area under a perfectly equal distribution. The Lorenz curve refers to an example income distribution.

Although they are a private company, Crédit Suisse are widely respected, use a transparent method (Shorrocks, Davies, & Lluberas, 2014) and give quality ratings for the estimations for each country.

Their definition of wealth refers to financial assets, housing and land, and liabilities are subtracted and their analysis applies to adults individuals (i.e. not households) aged over 20. Estimations of wealth inequality are largely derived from a model with income inequality as its main input, plus household balance sheets when available.

The equation for this indicator is different from the others used in the index. It represents a square transformation which has been inverted and shifted towards the y axis. Superficially similar to a logarithmic transformation, it gives a steeper gradient in mid-values for better differentiation, differentiates little between very low Gini coefficients (e.g. 0.3 is 91) and gives better differentiation and a steadier, steeper gradient in the relevant range of values 0.6-0.8. The logarithmic transform has m<0.5 in most of the range below 0.75, an undesirable property compared to a straight line equation.
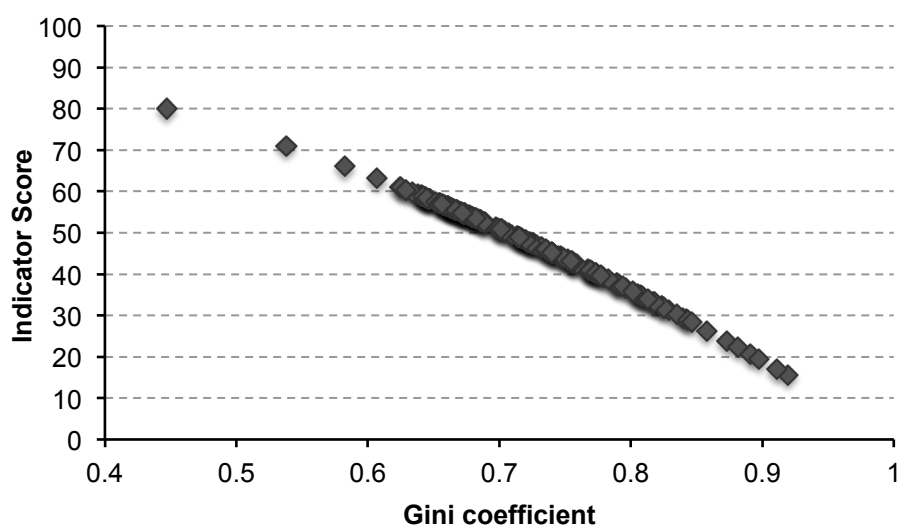
Figure 15: Relationship between wealth inequality indicator scores and wealth-Gini coefficient.

4.4.3.2 Theoretical basis

There are several reasons why greater wealth equality might benefit the wellbeing of future generations. First is a non-obvious point: one of the main drivers of wealth inequality is debt and assets related to home ownership, in turn often related to house price inflation which disproportionately favours the wealthy and the old who have paid off full equity of their home. For example, Denmark has enormous average individual debt (c. $41000 per capita – the highest in the world, unadjusted) resulting in net *negative* wealth for the bottom 30% of the population[14]. As a result it has the third-highest Gini coefficient despite the top decile having a similar amount of wealth to other, better-faring Northern European countries (Shorrocks et al., 2014). Thus, Denmark's distribution of wealth seems much less beneficial to future generations than other similar countries.

Second, it is in some sense a measure of the distribution of the Adjusted Net Savings described previously, and thus indicates how much of the population has access to those savings. Related to this is an ethical argument about the inheritance of future generations, based on the well-known "veil of ignorance" theory (Rawls, 1999) of morality and a widely-held value that wealth should be

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[14] This is also down to high levels of social support for housing in Scandinavian countries, where state housing is common and rents are heavily regulated, arguably reducing the necessity of wealth equality in society. Supporting this interpretation is the fact that inheritance taxes are low in Denmark and non-existent in Norway and Sweden.

held equally or meritocratically, not arbitrarily (Piketty, 2014). Piketty notes (p.433), "Inequalities must therefore be just and useful to all… 'Social distinctions can be based only on common utility,' according to article 1 of the 1789 Declaration of the Rights of Man and the Citizen" and further argues that high wealth inequality paves the way for even greater inequality and can undermine the stability of society over time. Given an assumption that economic growth is not infinite, it seems likely that poverty reduction will require wealth redistribution (Daly, 1990). Also, it seems reasonable that equal wealth distribution indicates long-term social planning and a healthy social structure, as it requires strong redistributive institutions and takes time to implement.

A Gini index of 0 is unachievable and may also be undesirable within the current economic framework; there may well be diminishing returns to wellbeing below a certain level. However, given the absence of an empirically-derived "ideal" value of wealth inequality, it seems acceptable to use it as an upper benchmark for ranging until there is more academic consensus on 'optimum' inequality.

4.4.3.3   Future Directions

Measurements of household wealth are still in their infancy. This method and data for this indicator should be given particular scrutiny in future updates.

4.5 Social Indicators

The social dimension of sustainability is notoriously difficult to define, and has been characterised as "a concept in chaos" (Vallance, Perkins, & Dixon, 2011). In building a social dimension to this index of intergenerational solidarity, I based my choice of indicators on the inheritance of human capital in the form of education and health, and searched in vain for a good measure of future social capital. It is comforting that (Vemuri & Costanza, 2006) could find no measure of social capital that adequately related even to current wellbeing, and that (Glaeser, La Porta, Lopez-de-Silanes, & Shleifer, 2004) found no necessary relationship between institutional quality (a common measure of social capital), growth and poverty-reduction, and considered most measures of institutions to be "conceptually unsuitable" for measuring what they purported. As a compromise, I used the fertility rate as an indicator of social capital, arguing that it may predict social instabilities that lead to negative effects on human capital.

4.5.1 Social Indicator: Primary Pupil-Teacher Ratio

Table 15: Equation, definition and data source for primary pupil-teacher indicator.

Metric	0 =	100 =	Equation	Time period	Source
Pupil-teacher ratio in public primary schools	50:1	10:1	$100\left(\dfrac{50-x}{50-10}\right)$	10-year average (2002-2012)	UNESCO (2015) and ACARA (2011, 2013); Agency for Statistics of Bosnia and Herzegovina (2011); Lomborg (2009); OECD (2014); Wolff (2008)

4.5.1.1   The indicator

This indicator measures the number of teachers (i.e. excluding other school staff) for every pupil in publicly-funded primary education which is usually defined as the first six years of school where systematic education begins and subjects are not yet differentiated into separate classes (UNESCO,

2012). Most data comes from a central UNESCO database, but additional data is estimated for other countries as noted to improve coverage. Due to poor collection, some countries have only one data point in the last 10 years, hence the long average. On the other hand, it seems likely that pupil head-counts might be more precise than some other indicators, as it is easier to count people than e.g. carbon footprint. It should also be noted that this indicator is not class size, though it indicates it. Teachers may be part-time, or spend more or less working time preparing for lessons, or work together, or teach classes for minorities.

Due to lack of conclusive targets in the literature, the indicator benchmarks were based mostly on a subjective assessment of data distribution, with no transformation. Only three countries in the index (Iceland, Sweden and Norway) had better ratios than 10:1, and only 10 nations had ratios greater than 50:1, ranging up to 76:1 for Malawi (Figure 16). The boundaries were also somewhat informed by the fact that "large class size" is sometimes defined as >50:1 (Jin & Cortazzi, 1998; Qiang & Ning, 2011) and that Krueger (2011) found improved results for class size down to 15:1.

Changes in the values of the benchmarks were also analysed to ensure that overall index results were not sensitive to them; e.g. a lower boundary of 60:1 would affect index scores by <1 point on average, and change rankings by an average of 2 places, with very little effects on the countries at the top of the rankings.
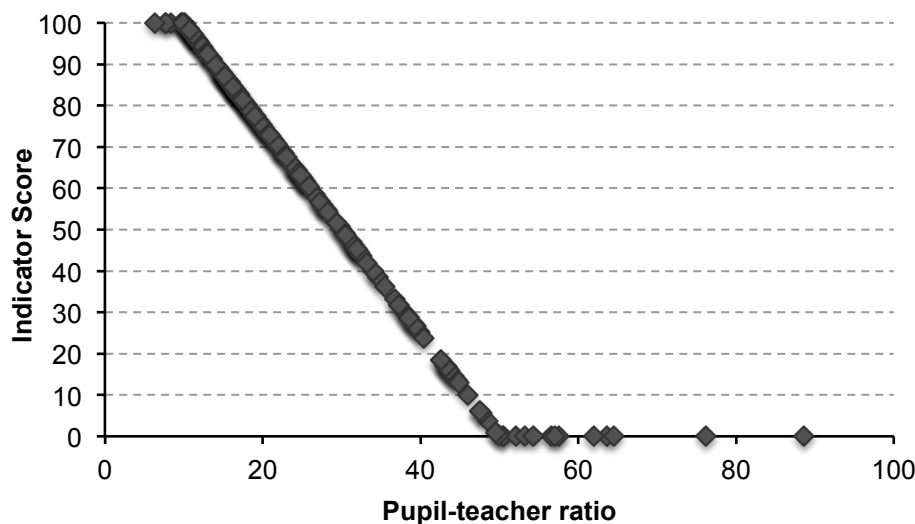
Figure 16: Relationship between pupil-teacher ratio indicator score and pupil-teacher ratio.

4.5.2 Theoretical basis

Primary education was specifically chosen because it is an investment in the wellbeing of future generations that is not likely to directly benefit current generations very much for 10-20 years at least. Also, as (United Nations, 2013) puts it, "Education is itself critical to intergenerational solidarity as the means of transmitting accumulated, or at least the most recent, scientific and other knowledge to future generations." Regardless of educational outcomes, it is also indicative of a more general societal willingness to trade off current wellbeing (money spent on teachers' salary) for others in the future (Kasser, 2011) and therefore works both as a proxy and an important constituent of intergenerational solidarity.

Secondary and particularly tertiary education were excluded because of lower attendance, because they are less comparable between countries due to greater differences in public and private education models, and because they are more directly linked to the economic interests of current

generations. They also will be much more influenced by a country's existing wealth, so will not address the principle of measuring proportional solidarity.

It is common for indicators of educational capital in composite indices to use years of schooling or spending on education as a percent of GDP/c. I chose the pupil-teacher ratio as years of primary education do not vary meaningfully outside of the least developed countries, and because the number of teaching staff probably has a closer relationship with education outcomes than spending more generally, although no one indicator is very reliable (Glewwe, Hanushek, Humpage, & Ravina, 2013).

4.5.2.1 Future Directions

In some nations with pyramidal demographic structures, a high pupil-teacher ratio may not be caused by lower prioritisation of education, but instead by the ratio of children to adults. It may be possible to correct for this. Also, as research into educational indicators advance, alternative measures with international coverage may emerge, and should be adopted. A priority for this indicator should also be to incorporate research into the differential effects of pupil-teacher ratio on educational achievement. It seems quite unlikely that there is a purely linear effect, and the cut-offs are currently based solely on data distribution.

4.5.3 Social Indicator: Fertility Rate

Table 16: Equation, definition and data source for fertility rate indicator.

Metric	0	100	Equation	Time period	Source
Predicted number of children per woman in five years projected using a five-year average (*x*), corrected for child (<5 years) mortality (*y*)	n/a	1.8	$100 \left(\dfrac{1.8}{1.8 + \sqrt{(1.8 - x)^2}} \right)^2 \cdot y$	5-year prediction (2017) based on 5-year regression (2008-2012)	World Bank, (2015b)

4.5.3.1 The indicator

This indicator measures the predicted fertility rate using a linear extrapolation of the trend of the last five years, in order to recognise countries with a strong current policy towards achieving 'optimum' fertility rates (as defined below) via encouraging or discouraging having children. Countries where the regression coefficient for the previous five years was ≤0.5 were instead predicted using the average of the last five years. The indicator score is calculated using the formula, above, giving a representation of "distance from the optimum", either positive or negative (Figure 17). The square of the full fraction was added to address the fact that population does not grow or shrink linearly and small differences make large effects; if left unsquared, a fertility rate of 7.2 would score 25 despite being socially problematic.

The selected optimum value of 1.8 is theoretically based on an assumed replacement-level fertility of 2.1, and explained further below. The figure of 2.1 is inaccurate for countries with significant mortality rates before menopause (Espenshade, Guzman, & Westoff, 2003). As a partial correction for this, fertility rates were multiplied by the fraction of children surviving to 5 years; data for later pre-fertility years could not be currently obtained.
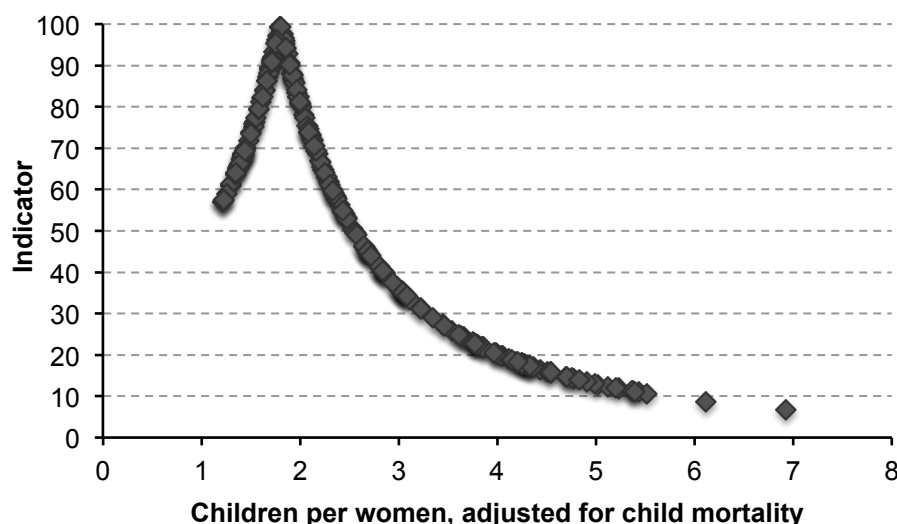
Figure 17: Relationship between fertility rate indicator and adjusted fertility rate.

4.5.3.2 Theoretical basis

Population growth and decline is a thorny ethical issue that has been poorly and simplistically addressed in economics and sustainability literature. However, there are several strong arguments for its inclusion in a measure of intergenerational solidarity.

First, as part of the I=f(P,A,T) equation (Alcott, 2010), all else being equal, population growth may negatively affect future wellbeing through reduction in per-capita scarce resources, e.g. water (Vörösmarty, Green, Salisbury, & Lammers, 2000). A rising population may also increase impact on the environment. This should carry the caveat that effects on the environment are unlikely to be linear especially outside of the developed world, as the majority of population growth in developing nations comes from the most impoverished families with the lowest footprints, although there is not a necessary causal link between those two factors (Aasve et al., 2005). However, in most of the world, the silver lining for the environment comes with a corresponding cloud of grave social impacts, including increasing inequality, expansion of slums, pressure on social institutions and all of the miseries of absolute poverty that economists might describe as 'reduced per-capita human and social capital' (M. Davis, 2006).

Another point is that, at least in neoclassical economics, GDP per capita is a proxy for social wellbeing. Thus, a growth in population requires economic growth of the same magnitude to maintain wellbeing, which is certainly not inevitable. For example, GDP per capita has fallen in the UK since 2007 due to slow growth and comparatively large population increases (Berry, 2014).

A shrinking population might be beneficial in these areas, implying that GDP, footprint and so on may be reduced while maintaining or increasing GDP per capita, or that immigrants from other countries might be accommodated. In addition, it might mean that expansion of expensive fixed infrastructure (houses, roads etc.) is less necessary and that education spending need not be so high. However, too much reduction at once unbalances the demographic model, and means that few young people are left to care and pay for elderly dependents. This is especially so if, as in many developed countries, lifespans have increased but pensioning ages have not. It may also result in so-called "government of the elderly, by the elderly and for the elderly" as in Japan (Coulmas, 2007, p. 92). Thus the results of such a sharp demographic transition, as faced by Japan and many European countries, may mean lower wellbeing for children and an excessive consumption by older people. This said, it is not clear how much this extends generations in the distant future.

Thus, on balance, it seems prudent for countries to aim for fertility rates of less than replacement, but not too low. It might also be hoped that death rates have reduced over the next two decades to the point where this is less of an issue. 1.8 was chosen relatively arbitrarily compared to other indicators in this index; China's current fertility rate of 1.66 resulting from the (rather inaccurately-named) "one-child policy" was used as an estimate of a low but relatively unproblematic value, and there seemed to be a number of countries not know for demographic problems predicted to be between 1.7 and 1.9, e.g. Chile, United States, Finland, Iran, Turkey.

A number of other indicators based on birth rates and population trends were examined, but all suffered from disadvantaging countries with increasing longevity or aging population demographics; future wellbeing would in theory be higher if there were few people living longer, healthier lives than many people leading short, more difficult ones. In addition, fertility rates ignore migration (and 1.8 allows for some migration), which have the potential to temporarily conceal unsustainable trends in average fertility if I were to use simple population change figures.

4.5.3.3 Future Directions

It's preferable to correct for differences in the death rates of children and younger adults in a more extensive way than using just child mortality rates. Net reproduction rate (Espenshade et al., 2003) should replace the current formula as soon as data makes it feasible; the best current data is of five-year averages and estimates, the most recent using 2005-2010 data (UN DESA, 2012), which is not recent or granular enough for the requirements of this index. Further research should also be done on the relative effects of low and high fertility rates as currently the indicator assumes a symmetrical undesirability.

4.5.4 Social Indicator: GDP-Adjusted Child Mortality

Table 17: Equation, definition and data source for child mortality indicator.

Metric	0	100	Equation	Time period	Source
% difference between actual child mortality and predicted child mortality	≥50%	≤-50%	$100\left(\dfrac{x-50}{-50-50}\right)$ [See Figure 18 for equation used to predict values]	5-year average (2008-2012)	UN Inter-agency Group for Child Mortality Estimation, (2015)

4.5.4.1 The indicator

This indicator examines child (under-5 years of age) mortality. In order to correct for GDP (see rationale below), for each year a power regression was calculated (Figure 18) which was used to estimate what child mortality 'should' be based on a country's per-capita income. Observed child mortality was expressed as a percentage of this, and entered into the equation above. The upper and lower benchmarks were chosen based on the data range, and for explanatory power: a score of 50 is equivalent to matching the predicted mortality rate, and every point of difference from that is % distance from that rate (i.e. a score of 75 implies a country is 25% below the predicted mortality rate).
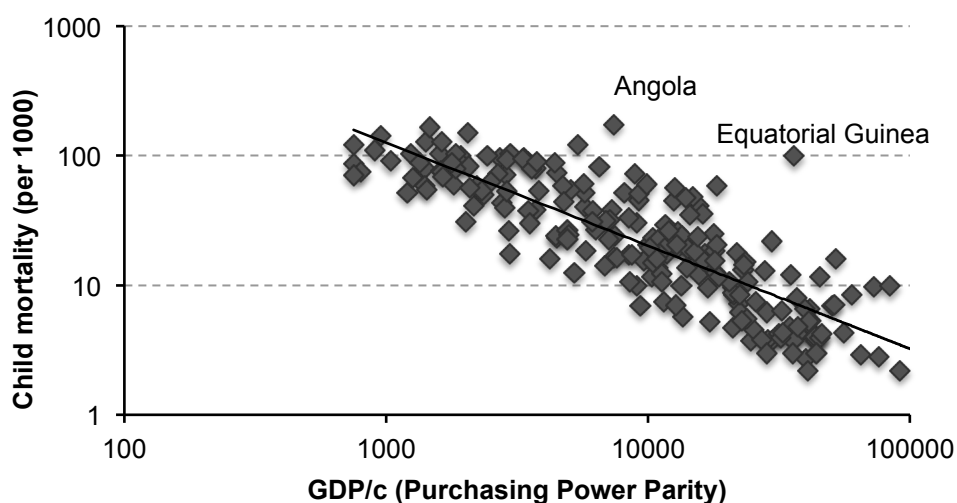
Figure 18: Log-log relationship between child mortality and GDP/c in 2012, with regression best fit. r^2=0.70 p<0.01, $y = 30482x^{-0.795}$.

4.5.4.2 Theoretical basis

Health is one the main forms of human capital that are passed on between generations and child mortality is used here as an indicator of the health component of the next generation's human capital. It is also widely regarded as one of the best indicators of current national health status (Wang, 2002). However, GDP is likely to be a significant causal variable (O'Hare, Makuta, Chiwaula, & Bar-Zeev, 2013); of the years 2008-2012 it predicted an average of 74.9% of variance in child mortality (log-log, see Figure 18 for 2012's regression) and, needless to say, income to a large extent governs the determinants of health, such as diet, sanitation, lifestyle and medicine. For the purposes of this index, we are looking for indicators of intergenerational solidarity proportional to ability to give; as GDP determines to a great extent both 'ability to give', it seems reasonable to control for it. To illustrate, Iceland has one of the lowest child mortality rates in the world, declining from 2.7 to 2.2 per 1000 over 2008-12. Based on the regression of all countries, and given its GDP of $44 200, we might expect it to have a 2012 child mortality rate of 5.3; it is doing more than twice as well as might be expected, and therefore receives 100 in the index. Other countries with similar ratios are Cuba, South Korea and Eritrea; while Eritrea has a 2012 child mortality rate of 51.6 per 1000, it is so poor that this is around half its expected rate, and its high score in the indicator is supported by its comparatively successful campaigns against malaria (Mufunda et al., 2007) and maternal mortality (Holzgreve, Greiner, & Schwidtal, 2012). At the other end of the index are many resource-rich countries such as Angola and Equatorial Guinea, where comparatively high per-capita GDP ($5540 and $22400 respectively) has not yet translated into low infant mortality (172.6 and 99 per 1000). In the middle with an indicator score of 52 is Norway – its low infant mortality (2.9) is entirely predicted by its very high GDP.

There seems to be several causal pathways to decreasing child mortality, and disagreement about which are most important in which contexts. In developing nations, a considerable amount of the variance seems to be driven by female education (Filmer & Pritchett, 1999; Gakidou, Cowling, Lozano, & Murray, 2010), another form of intergenerational capital transfer which this indicator may be a proxy for. In rural areas, vaccination and other preventative health measures such as malaria nets or improvements in nutrition may be crucial determinants (Amouzou, Habi, & Bensaïd, 2012; Wang, 2002). In wealthy countries such as the United Kingdom, differences in child mortality are more likely to be attributed to socioeconomic inequality; drug, tobacco and alcohol abuse; malnutrition; injuries and so on (Wolfe, Macfarlane, Donkin, Marmot, & Viner, 2014).

4.5.4.3 Future Directions

This indicator is fundamentally related to the annual derivation of the relationship between GDP and child mortality. If the relationship between these variables becomes less significant or precise, or it can be shown that the general relationship between GDP and child mortality is not in fact causal, then the indicator method should be changed to reflect this.
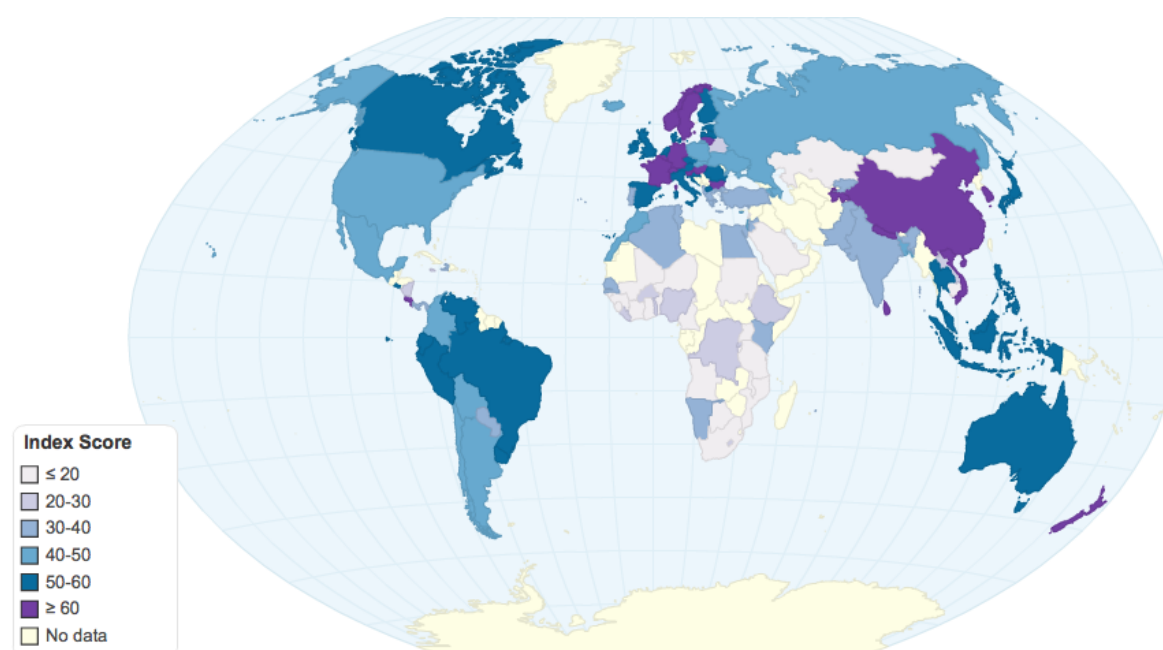
4.6 Results

4.6.1 Map of results

Figure 19: Choropleth map of index score.

4.6.2 Distribution of countries

The full table of results for the index can be seen in Appendix VI. In total, 120 countries covering 92.4% of the world's population were included. Most countries were in the middle of the range, with the median being 42 and the mean being 40. Norway was the best performing country by some way (78 vs. 70 for the next highest, Costa Rica), and Mongolia took bottom place with 10. Table 18 shows some cultural divisions of particular note.

Within these groups, there are some outliers of note. In the OECD, the Turkey, Greece and Portugal have low of 32 and 33, while the USA does only marginally better on 40. In Latin America, Nicaragua trails on 24, behind next-placed Paraguay on 36, but Costa Rica comes second in the world on 70, 10 points ahead of Peru.

It is important to note that these categories exclude some countries where there were insufficient data, particularly very small countries, Sub-Sahara and the Middle East, a non-random bias that will affect any cross-cultural comparisons and statistics.

Table 18: Selected mean index scores and ranges of different groups of countries.

	Mean	Range
Countries with constitutional reference to future generations: Uganda; Burundi; Malawi; Jamaica; Qatar; Zambia; Ghana; South Africa; Portugal; Lesotho; Kenya; Albania; Armenia; Argentina; Bolivia; Poland; Morocco; Namibia; Brazil; Ecuador; Russian Federation; Czech Republic; Venezuela; Switzerland; France; Germany; Tajikistan; Sweden; Norway (Boyd, 2011, p. 311)	42	65
"Second World" (Former Yugoslav/Soviet/Chinese bloc): Azerbaijan; Lithuania; Vietnam; Tajikistan; Latvia; China; Russian Federation; Estonia; Ukraine; Armenia; Kyrgyz Republic; Belarus; Kazakhstan; Mongolia; Poland; Slovakia; Romania; Bulgaria; Hungary; Czech Republic; Albania; Macedonia; Croatia; Slovenia, Lao, Cambodia	47	58
Nordic Countries: Sweden, Norway, Denmark, Finland, Iceland	61	28
Anglosphere: UK; USA; New Zealand, Australia, Canada, Ireland	53	24
Latin America: Costa Rica; Venezuela, RB; Peru; Ecuador; Brazil; Uruguay; Bolivia; Colombia; Argentina; Chile; Panamas; Paraguay; Nicaragua	47	46
Sub-Sahara: Mauritius; Kenya; Namibia; Senegal; Burkina Faso; Rwanda; Ethiopia; Congo, Dem. Rep.; Lesotho; Togo; Nigeria; Liberia; Botswana; South Africa; Ghana; Sudan; Cameroon; Tanzania; Cote d'Ivoire; Malawi; Guinea; Zambia; Angola; Benin; Mali; Burundi; Niger; Uganda; Sierra Leone; Mozambique; Guinea-Bissau	21	24
Oil-Producers (>1000 litres per capita per year; CIA, 2012)**:** Norway; Azerbaijan; Venezuela; Canada; Russian Federation; Denmark; Ecuador; Mexico; Australia; Algeria; Malaysia; Colombia; Nigeria; USA; Kazkhstan; Saudi Arabia; Angola; Kuwait	39	63
OECD: USA; Greece; Portugal; Chile; Israel; Poland; Turkey; Australia; Mexico; Slovakia; Estonia; Netherlands; Ireland; Spain; South Korea; Denmark; Italy; United Kingdom; Canada; Czech Republic; Japan; Switzerland; New Zealand; France; Austria; Finland; Germany; Belgium; Hungary; Slovenia; Norway; Iceland	54	46
Confucian: Vietnam; China; Japan; South Korea	63	11

Table 19: Descriptive statistics of indicators and index. Deciles are determined based on final index score, not indicator score.

	Mean of top decile	Mean	Median	Mean of bottom decile	Range
Forest Degradation	81	72	76	41	100
Carbon Footprint	60	67	75	81	93
Low-Carbon Energy	43	28	25	19	100
Environmental Average	55	43	44	31	85
Wealth Inequality	52	47	49	54	64
Current Account	90	64	74	26	100
Adjusted Net Savings	69	42	34	14	100
Economic Average	67	42	45	18	79
Pupil-Teacher Ratio	81	62	74	25	100
Child Mortality	86	57	66	32	100
Fertility Rate	82	57	64	29	91
Social Average	83	52	57	15	94
Index	67	40	41	13	68

4.6.3 Correlations

Bivariate correlations are shown in Table 20. All of the indicators correlated significantly with the final score, aside from one based on inequality.

Table 20: Bivariate correlations (Spearman's ρ) of indicators, averages and selected variables.

	Forest Degradation	Carbon Footprint	Low-Carbon Energy	Environmental Average	Inequality	Current Account Balance	Adjusted Net Savings	Economic Average	Pupil-Teacher Ratio	Child Mortality	Fertility	Social Average	Index Average
Forest	1	-.229*	-0.069	.201*	0.003	0.016	0.068	0.111	.236*	0.075	.212*	.204*	.263**
Footprint	-.229*	1	0.02	.421**	0.173	-.434**	-.220*	-.375**	-.781**	-0.164	-.574**	-.516**	-.282**
Energy	-0.069	0.02	1	.747**	0.01	-0.037	-0.086	-0.054	0.075	.187*	0.152	.207*	.433**
Env. Average	.201*	.421**	.747**	1	0.06	-.201*	-0.144	-0.156	-.227*	0.032	-0.034	-0.029	.309**
Inequality	0.003	0.173	0.01	0.06	1	-.273**	-.228*	-0.158	-.196*	0.174	-.192*	-0.056	-0.141
BoP	0.016	-.434**	-0.037	-.201*	-.273**	1	.376**	.768**	.467**	-0.029	.374**	.270**	.472**
Savings	0.068	-.220*	-0.086	-0.144	-.228*	.376**	1	.779**	.267**	0.118	.305**	.262**	.490**
Econ. Average	0.111	-.375**	-0.054	-0.156	-0.158	.768**	.779**	1	.426**	0.098	.406**	.342**	.645**

Teachers	.236*	-.781**	0.075	-.227*	-.196*	.467**	.267**	.426**	1	.268**	.688**	.733**	.513**
Child Mortality	0.075	-0.164	.187*	0.032	0.174	-0.029	0.118	0.098	.268**	1	.275**	.711**	.466**
Fertility	.212*	-.574**	0.152	-0.034	-.192*	.374**	.305**	.406**	.688**	.275**	1	.725**	.588**
Social Average	.204*	-.516**	.207*	-0.029	-0.056	.270**	.262**	.342**	.733**	.711**	.725**	1	.724**
Index Average	.263**	-.282**	.433**	.309**	-0.141	.472**	.490**	.645**	.513**	.466**	.588**	.724**	1
Population	0.026	.185*	-0.023	0.102	-.190*	0.135	0.048	0.122	-.233*	-0.113	-0.119	-.191*	0.114
GDP/c (2013)	.234*	-.860**	0.119	-.236**	-.314**	.552**	.274**	.471**	.864**	0.115	.702**	.603**	.466**
Density (2013)	0.142	-0.152	-0.082	-0.032	0.05	0.062	.209*	.216*	0.045	.293**	0.108	0.153	0.149

. ** p<.01 *p<.05 (two-tailed).

4.7 Discussion

4.7.1 How useful is the index?

After compiling an index, it is important to sense-check it. Does it say anything useful? Does it react well to different data inputs? This section summarises some of the indications that it works well.

4.7.1.1 Geometric Aggregation

The use of geometric aggregation has allowed the index to react well to extremes of poor performance, even in only one dimension. For example, regarding low performance in one field, Paraguay has middling economic and slightly below-average social components, and its carbon footprint and renewable energy use are among the best in the world. However, given it has the worst forest degradation rate in the world (an astonishing annual average of 16.8%), its final score of 32 is much lower than it might otherwise be – if it had even the same degradation rate as Brazil, its final score would have jumped to 50 – and gives a clear message that forest degradation should a high priority for Paraguayan policymakers.

4.7.1.2 Correlations

All but one of the indicators correlated with the final outcome. The standard deviation for wealth inequality was low (10.9) even after a square transformation, which is likely one reason for this. This does not necessarily suggest that it should be excluded however, given its theoretical justification as an important constituent of intergenerational solidarity. Indeed, it may come to be of more discriminative use in the future as wealth inequality in many countries is rising (Stierli et al., 2014).

The negative correlation of the index with carbon footprint score is almost certainly driven by poor, low-footprint countries but further development in these countries will lead to it becoming a more important indicator, and it currently serves to adjust rankings in a non-systematic way. For example, it is worth noting that five of the top 10 scoring countries had footprints of 0.8Gha/c or below (the target being 0.6Gha), whereas five were above 1.5Gha/c.

4.7.1.3 Differentiation

One of features of a good index is that it is interesting, i.e. it differentiates superficially similar countries and provides a good explanation for that. For example, it may be surprising that the USA's score of 40 is so low compared to similar countries in the OECD (Table 18); however, this can be traced partly to high inequality and carbon footprints, low savings rates and very poor child

mortality rates given its GDP per capita. Thus, the USA can be said to generally act less in the interests of future generations than other similar countries, something that is not necessarily apparent from individual indicators.

Another point of note is that despite their generally high scores, the three Scandinavian countries are further spread than might be expected for such culturally, linguistically, economically and ethnically homogenous countries. The root causes can be traced to varying investments in renewable energy, savings, and differing inequality; e.g. as a result of many citizens owning net *negative* wealth through debt, Denmark has the third highest wealth inequality Gini coefficient in the world. Interestingly, forest degradation appears highest in Sweden, despite having by far the most forest area per capita. Iceland, which shares many cultural features of Scandinavia, fares the worst of all the Nordic countries despite very good environmental and social scores. This is entirely caused by its recent history of economic mismanagement and consequential current account and savings problems.

4.7.2 Patterns of note

4.7.2.1   High and Low Performers

At the high end, it seems that the highest scores are generally driven by good performance in all of the social indicators, healthy current account balances and high savings (Table 19), while environmental indicators are not much above the median aside from low-carbon energy generation (+20). At the other end of the scale, the differences seem to be driven by forest degradation (the bottom decile are on average -34 points from the median), balances of payments (-45 points), pupil-teacher ratios (-45 points), and fertility rates (-31 points).

4.7.2.2   Cultures and groupings

In dividing up the world into some social and economic groupings (Table 18), some patterns can be discerned. Despite the top 10 containing three post-communist countries, one communist country (Vietnam; China is 11th) and two Nordic social democracies, countries with socialist or communist heritage have a wide range of scores and this group contains the overall lowest country (Mongolia). Further research might investigate the particulars of the legacy of socialist planning on their levels of intergenerational solidarity; it may be that certain countries have retained the kind of long-term orientation that characterised planned economies (Ellman, 2014). Perhaps unsurprisingly, the Nordic social democracies all score above-average, but the four Confucian nations included do even better; some researchers have proposed that long-termism is an inherent part of Confucian culture (e.g. Hofstede, 1993) and this adds some evidence to this suggestion. In an interesting contrast, it appears that reference in a nation's constitution to future generations is irrelevant to actual actions – these countries perform no better than others on average. Also, the large oil incomes that fund some nations' sovereign wealth investment funds – Norway and Saudi Arabia, for instance – do not appear to have a universal effect on intergenerational solidarity, with countries producing >1000l/c/a. scoring similar to the index average.

4.7.2.3   Correlates

There are some interesting relationships with national variables of population density, population and GDP per capita (Table 20). It seems that there is relatively little relationship with density or population, thus casting doubt on the idea that intergenerational solidarity may be something that is particularly easy for sparsely-populated or small countries. However, despite attempting to measure proportionality and thus expressing a preference for indicators that were not purely proxies for income, GDP/c does have a large and significant relationship with several indicators and a medium relationship with the overall index. This may indicate a non-linear causal relationship with income,

i.e. that rich countries can give proportionally more to future generations or that long-termist countries end up with higher incomes. (Rawls, 1999) suggests that this is the case: "When people are poor and saving is difficult, a lower rate of saving should be required; whereas in a wealthier society greater savings may reasonably be expected since the real burden of saving is less."

However, the correlation does only predict 22% of variance and there are many outliers; it is quite likely that much of the effect comes from the generally poor performance of Sub-Saharan African countries suffering from well-documented composite socioeconomic and institutional problems. IT should be noted that within the top decile, there is a very wide range of average incomes, from $694 in Nepal and $3279 in Sri Lanka to over $100000 in Norway.

4.7.3 Suggestions for improvement

Rawls (1999, p. 256) asserts "*Each passes on to the next a fair equivalent in real capital as defined by a just savings principle… capital is not only factories and machines, and so on, but also the knowledge and culture, as well as the techniques and skills, that make possible just institutions and the fair value of liberty.*"

I was not able to capture the kinds of capital he mentions, except through a measure of each nation's investment in primary education. Further consideration should be given to these as the coverage and quality of measurement of social capital improves, and also to alternative indicators of natural capital which he fails to mention.

Further editions of the index might also take into account cross-cultural surveys about our attitudes and behaviour towards the future, for example the Consideration of Future Consequences Scale (Strathman et al., 1994) or the Zimbardo Time Perspective Inventory (Zimbardo & Boyd, 1999). An interesting project in itself would be to see if future orientation by either of these measures correlates with the results of this index. Similarly interesting would be further research into the reasons for high index scores, particularly as to whether 'Confucianism' can really explain why Korea, Japan, China and Vietnam score so highly.

4.8 Conclusion

This index is, to my knowledge, the first attempt to construct a multidimensional composite measure of intergenerational solidarity. It is far from being a precise or accurate measure, but in this regard it suffers from the same limitations as all composite indices, and accounts for some of the problems in others such as the assumption of perfect substitution between indicators.

Despite its limitations, the usefulness of a composite figure is shown in revealing interesting patterns of nations, for example that high income does not necessarily guarantee proportionally high levels of intergenerational solidarity, that constitutional reference to future generations is largely irrelevant to action in their interests, and that countries with a Confucian heritage do seem to act more in the interests of future generations. Where it may be most useful is in the decomposition of national scores to look for plausible reasons behind a lack of intergenerational solidarity. Hopefully this index can be refined and updated and assist further research into the causes of intergenerational solidarity.

5 Concluding Remarks

If our species and biosphere is to continue to thrive, it is clear that more attention must be paid to the consequences of our actions, that we must plan better and care more. The work contained in this thesis can assist research in this area, by facilitating comparisons of collective intergenerational solidarity between nations, by allowing important cross-cultural psychological studies between Iceland and other nations, and by providing research directions into the underlying causes of our consideration of the future.

The task of prioritisting the future in our planning may seem daunting, but we live in a world that is testament to the long-term plans and actions of our ancestors. This thesis was conceived in an oak-coppice forest in Wales, whilst tending to trees planted in 150 year rotations for the benefit of distant generations. If medieval charcoal-burners and foresters – some of the poorest classes of peasants – were able to be so magnanimous, then it is surely possible for us to emulate their example.

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Appendix I – Portrait Values Questionnaire-RR (English/Female)

[N.B. Survey was online; formatting here does not reflect that of the online questionnaire]

Here we briefly describe different people. Please read each description and think about how much that person is or is not like you. Put an X in the box to the right that shows how much the person described is like you.

HOW MUCH LIKE YOU IS THIS PERSON?

	Not like me at all	Not like me	A little like me	Moderately like me	Like me	Very much like me
1. It is important to her to form her views independently.	☐	☐	☐	☐	☐	☐
2. It is important to her that her country is secure and stable.	☐	☐	☐	☐	☐	☐
3. It is important to her to have a good time.	☐	☐	☐	☐	☐	☐
4. It is important to her to avoid upsetting other people.	☐	☐	☐	☐	☐	☐
5. It is important to her that the weak and vulnerable in society be protected.	☐	☐	☐	☐	☐	☐
6. It is important to her that people do what she says they should.	☐	☐	☐	☐	☐	☐
7. It is important to her never to think she deserves more than other people.	☐	☐	☐	☐	☐	☐
8. It is important to her to care for nature.	☐	☐	☐	☐	☐	☐
9. It is important to her that no one should ever shame her.	☐	☐	☐	☐	☐	☐
10. It is important to her always to look for different things to do.	☐	☐	☐	☐	☐	☐
11. It is important to her to take care of people she is close to.	☐	☐	☐	☐	☐	☐
12. It is important to her to have the power that money can bring.	☐	☐	☐	☐	☐	☐
13. It is very important to her to avoid disease and protect her health.	☐	☐	☐	☐	☐	☐
14. It is important to her to be tolerant toward all kinds of people and groups.	☐	☐	☐	☐	☐	☐
15. It is important to her never to violate rules or regulations.	☐	☐	☐	☐	☐	☐
16. It is important to her to make her own decisions about her life.	☐	☐	☐	☐	☐	☐
17. It is important to her to have ambitions in life.	☐	☐	☐	☐	☐	☐

18. It is important to her to maintain traditional values and ways of thinking. ☐ ☐ ☐ ☐ ☐ ☐

19. It is important to her that people she knows have full confidence in her. ☐ ☐ ☐ ☐ ☐ ☐

20. It is important to her to be wealthy. ☐ ☐ ☐ ☐ ☐ ☐

21. It is important to her to take part in activities to defend nature. ☐ ☐ ☐ ☐ ☐ ☐

22. It is important to her never to annoy anyone. ☐ ☐ ☐ ☐ ☐ ☐

23. It is important to her to develop her own opinions. ☐ ☐ ☐ ☐ ☐ ☐

24. It is important to her to protect her public image. ☐ ☐ ☐ ☐ ☐ ☐

25. It is very important to her to help the people dear to her. ☐ ☐ ☐ ☐ ☐ ☐

26. It is important to her to be personally safe and secure. ☐ ☐ ☐ ☐ ☐ ☐

27. It is important to her to be a dependable and trustworthy friend. ☐ ☐ ☐ ☐ ☐ ☐

28. It is important to her to take risks that make life exciting. ☐ ☐ ☐ ☐ ☐ ☐

29. It is important to her to have the power to make people do what she wants.. ☐ ☐ ☐ ☐ ☐ ☐

30. It is important to him to plan her activities independently. ☐ ☐ ☐ ☐ ☐ ☐

31. It is important to her to follow rules even when no-one is watching. ☐ ☐ ☐ ☐ ☐ ☐

32. It is important to her to be very successful. ☐ ☐ ☐ ☐ ☐ ☐

33. It is important to her to follow her family's customs or the customs of a religion. ☐ ☐ ☐ ☐ ☐ ☐

34. It is important to her to listen to and understand people who are different from her. ☐ ☐ ☐ ☐ ☐ ☐

35. It is important to her to have a strong state that can defend its citizens. ☐ ☐ ☐ ☐ ☐ ☐

36. It is important to her to enjoy life's pleasures. ☐ ☐ ☐ ☐ ☐ ☐

37. It is important to her that every person in the world have equal opportunities in life. ☐ ☐ ☐ ☐ ☐ ☐

38. It is important to her to be humble. ☐ ☐ ☐ ☐ ☐ ☐

39. It is important to her to figure things out herself. ☐ ☐ ☐ ☐ ☐ ☐

40. It is important to her to honor the traditional practices of her culture. ☐ ☐ ☐ ☐ ☐ ☐

41. It is important to her to be the one who tells others what to do.. ☐ ☐ ☐ ☐ ☐ ☐

42. It is important to her to obey all the laws. ☐ ☐ ☐ ☐ ☐ ☐

43. It is important to her to have all sorts of new experiences.. ☐ ☐ ☐ ☐ ☐ ☐

44. It is important to her to own expensive things that show her wealth ☐ ☐ ☐ ☐ ☐ ☐

45. It is important to her to protect the natural environment from destruction or pollution. ☐ ☐ ☐ ☐ ☐ ☐

46. It is important to her to take advantage of every opportunity to have fun. ☐ ☐ ☐ ☐ ☐ ☐

47. It is important to her to concern herself with every need of her dear ones. ☐ ☐ ☐ ☐ ☐ ☐

48. It is important to her that people recognize what she achieves. ☐ ☐ ☐ ☐ ☐ ☐

49. It is important to her never to be humiliated. ☐ ☐ ☐ ☐ ☐ ☐

50. It is important to her that her country protect itself against all threats. ☐ ☐ ☐ ☐ ☐ ☐

51. It is important to her never to make other people angry. ☐ ☐ ☐ ☐ ☐ ☐

52. It is important to her that everyone be treated justly, even people she doesn't know. ☐ ☐ ☐ ☐ ☐ ☐

53. It is important to her to avoid anything dangerous. ☐ ☐ ☐ ☐ ☐ ☐

54. It is important to her to be satisfied with what she has and not ask for more. ☐ ☐ ☐ ☐ ☐ ☐

55. It is important to her that all her friends and family can rely on her completely. ☐ ☐ ☐ ☐ ☐ ☐

56. It is important to her to be free to choose what she does by herself.. ☐ ☐ ☐ ☐ ☐ ☐

57. It is important to her to accept people even when she disagrees with them. ☐ ☐ ☐ ☐ ☐ ☐

Appendix II – Portrait Values Questionnaire-RR (Icelandic/Female)

[Translation by Ragna Garðarsdóttir and Þröstur Þorsteinsson]

Hér lýsum við stuttlega mismunandi manneskjum. Vinsamlega lestu hverja lýsingu fyrir sig og hugsaðu um hversu lík eða ólík manneskjan sem þar er lýst er þér. Settu X í þann kassa hægra megin við lýsinguna sem sýnir best hversu lík þér manneskjan er.

	HVERSU LÍK ÞÉR ER ÞESSI MANNESKJA?					
	Ekkert líkt mér	Ekki líkt mér	Nokkuð líkt mér	Svolítið líkt mér	Líkt mér	Mjög líkt mér
1. Það er mikilvægt fyrir hana að mynda sér sjálfstæðar skoðanir.	☐	☐	☐	☐	☐	☐
2. Það er mikilvægt fyrir hana að í landinu hennar sé öryggi og stöðugleiki.	☐	☐	☐	☐	☐	☐
3. Það er mikilvægt fyrir hana að hafa gaman.	☐	☐	☐	☐	☐	☐
4. Það er mikilvægt fyrir hana að forðast að koma öðrum í uppnám.	☐	☐	☐	☐	☐	☐
5. Það er mikilvægt fyrir hana að þeir sem minna mega sín í samfélaginu séu verndaðir.	☐	☐	☐	☐	☐	☐
6. Það er mikilvægt fyrir hana að aðrir geri það sem hún segir þeim að gera.	☐	☐	☐	☐	☐	☐
7. Það er mikilvægt fyrir hana að finnast aldrei að hún eigi meira skilið en aðrir.	☐	☐	☐	☐	☐	☐
8. Það er mikilvægt fyrir hana að láta sér annt um náttúruna.	☐	☐	☐	☐	☐	☐
9. Það er mikilvægt fyrir hana að hún sé aldrei smánuð af öðrum.	☐	☐	☐	☐	☐	☐
10. Það er mikilvægt fyrir hana að leita sér stöðugt að ólíkum viðfangsefnum.	☐	☐	☐	☐	☐	☐
11. Það er mikilvægt fyrir hana að annast þá sem standa henni nærri.	☐	☐	☐	☐	☐	☐
12. Það er mikilvægt fyrir hana að hafa valdið sem getur fylgt peningum.	☐	☐	☐	☐	☐	☐
13. Það er mjög mikilvægt fyrir hana að forðast sjúkdóma og vernda heilsuna.	☐	☐	☐	☐	☐	☐
14. Það er mikilvægt fyrir hana að vera umburðarlynd gagnvart allskyns fólki og samfélagshópum.	☐	☐	☐	☐	☐	☐
15. Það er mikilvægt fyrir hana að brjóta aldrei lög eða reglur.	☐	☐	☐	☐	☐	☐
16. Það er mikilvægt fyrir hana að taka sjálf ákvarðanir um líf sitt.	☐	☐	☐	☐	☐	☐
17. Það er mikilvægt fyrir hana að hafa metnað.	☐	☐	☐	☐	☐	☐
18. Það er mikilvægt fyrir hana að halda í hefðbundin gildi og hugsunarhátt.	☐	☐	☐	☐	☐	☐

19. Það er mikilvægt fyrir hana að þeir sem hún þekkir beri fullt traust til hennar. ☐ ☐ ☐ ☐ ☐ ☐

20. Það er mikilvægt fyrir hana að vera rík. ☐ ☐ ☐ ☐ ☐ ☐

21. Það er mikilvægt fyrir hana að taka þátt í aðgerðum til að verja náttúruna. ☐ ☐ ☐ ☐ ☐ ☐

22. Það er mikilvægt fyrir hana að pirra aldrei aðra. ☐ ☐ ☐ ☐ ☐ ☐

23. Það er mikilvægt fyrir hana að þróa sitt eigið álit. ☐ ☐ ☐ ☐ ☐ ☐

24. Það er mikilvægt fyrir hana að verja ímynd sína út á við. ☐ ☐ ☐ ☐ ☐ ☐

25. Það er mjög mikilvægt fyrir hana að hjálpa þeim sem henni þykir vænt um. ☐ ☐ ☐ ☐ ☐ ☐

26. Það er mikilvægt fyrir hana að vera sjálf óhult og örugg. ☐ ☐ ☐ ☐ ☐ ☐

27. Það er mikilvægt fyrir hana að vera áreiðanlegur og traustur vinur. ☐ ☐ ☐ ☐ ☐ ☐

28. Það er mikilvægt fyrir hana að taka áhættu sem gerir lífið spennandi. ☐ ☐ ☐ ☐ ☐ ☐

29. Það er mikilvægt fyrir hana að hafa vald til að láta aðra gera það sem hún vill. ☐ ☐ ☐ ☐ ☐ ☐

30. Það er mikilvægt fyrir hana að plana sjálf athafnir sínar. ☐ ☐ ☐ ☐ ☐ ☐

31. Það er mikilvægt fyrir hana að fylgja reglum, jafnvel þegar enginn sér til. ☐ ☐ ☐ ☐ ☐ ☐

32. Það er mikilvægt fyrir hana að ná miklum árangri. ☐ ☐ ☐ ☐ ☐ ☐

33. Það er mikilvægt fyrir hana að fylgja hefðum sinnar fjölskyldu eða hefðum trúarbragða. ☐ ☐ ☐ ☐ ☐ ☐

34. Það er mikilvægt fyrir hana að hlusta á og skilja fólk sem er ólíkt henni. ☐ ☐ ☐ ☐ ☐ ☐

35. Það er mikilvægt fyrir hana að ríkið sé öflugt og geti verndað þegna sína. ☐ ☐ ☐ ☐ ☐ ☐

36. Það er mikilvægt fyrir hana að njóta lífsins lystisemda. ☐ ☐ ☐ ☐ ☐ ☐

37. Það er mikilvægt fyrir hana að allir í heiminum hafi jöfn tækifæri í lífinu. ☐ ☐ ☐ ☐ ☐ ☐

38. Það er mikilvægt fyrir hana að vera auðmjúk. ☐ ☐ ☐ ☐ ☐ ☐

39. Það er mikilvægt fyrir hana að komast sjálf til botns í hlutunum. ☐ ☐ ☐ ☐ ☐ ☐

40. Það er mikilvægt fyrir hana að virða gamalgrónar menningarlegar hefðir. ☐ ☐ ☐ ☐ ☐ ☐

41. Það er mikilvægt fyrir hana að vera sú sem segir öðrum hvað á að gera. ☐ ☐ ☐ ☐ ☐ ☐

42. Það er mikilvægt fyrir hana að fylgja öllum lögum. ☐ ☐ ☐ ☐ ☐ ☐

43. Það er mikilvægt fyrir hana að upplifa margvíslegt nýtt. ☐ ☐ ☐ ☐ ☐

44. Það er mikilvægt fyrir hana að eiga dýra hluti sem sýna auðæfi hennar. ☐ ☐ ☐ ☐ ☐

45. Það er mikilvægt fyrir hana að verja náttúrulegt umhverfi gegn eyðileggingu eða mengun. ☐ ☐ ☐ ☐ ☐ ☐

46. Það er mikilvægt fyrir hana að nýta hvert tækifæri sem gefst til skemmtunar. ☐ ☐ ☐ ☐ ☐ ☐

47. Það er mikilvægt fyrir hana að láta sig varða allar þarfir þeirra sem henni þykir vænt um. ☐ ☐ ☐ ☐ ☐ ☐

48. Það er mikilvægt fyrir hana að aðrir taki eftir hennar afrekum. ☐ ☐ ☐ ☐ ☐ ☐

49. Það er mikilvægt fyrir hana að vera aldrei niðurlægð. ☐ ☐ ☐ ☐ ☐ ☐

50. Það er mikilvægt fyrir hana að þjóð hennar geti varist öllum ógnum. ☐ ☐ ☐ ☐ ☐ ☐

51. Það er mikilvægt fyrir hana að reita aldrei neinn til reiði. ☐ ☐ ☐ ☐ ☐ ☐

52. Það er mikilvægt fyrir hana að allir njóti réttlætis, jafnvel þeir sem hún ekki þekkir. ☐ ☐ ☐ ☐ ☐ ☐

53. Það er mikilvægt fyrir hana að forðast allt sem er hættulegt. ☐ ☐ ☐ ☐ ☐ ☐

54. Það er mikilvægt fyrir hana að vera sátt við það sem hún á og biðja ekki um meira. ☐ ☐ ☐ ☐ ☐ ☐

55. Það er mikilvægt fyrir hana að allir vinir hennar og fjölskylda geti algerlega reitt sig á hana. ☐ ☐ ☐ ☐ ☐ ☐

56. Það er mikilvægt fyrir hana að hafa frelsi til að velja sjálf hvað hún gerir. ☐ ☐ ☐ ☐ ☐ ☐

57. Það er mikilvægt fyrir hana að taka annað fólk gott og gilt, jafnvel þótt hún sé ekki sammála því. ☐ ☐ ☐ ☐ ☐ ☐

Appendix III – CFC questionnaire (Icelandic)

Vinsamlegast segðu okkur fyrir hverja af eftirfarandi fullyrðingum hvort hún á við um þig eða ekki

HVERSU LÍK ÞÉR ER ÞESSI MANNESKJA?

	Á alls ekki við um mig	Á ekki við um mig	Hvorki né	Á nokkuð við um mig	Á mjög mikið við um mig
1. Ég velti fyrir mér hvernig framtíðin verður og reyni að hafa áhrif á hana með daglegri hegðun minni	☐	☐	☐	☐	☐
2. Ég geri oft tiltekna hluti til þess eins að nálgast markmið sem kynnu ekki að nást fyrr en eftir mörg ár	☐	☐	☐	☐	☐
3. Ég sinni aðeins því sem þarf að sinna strax, framtíðin mun sjá um sig sjálf	☐	☐	☐	☐	☐
4. Eingöngu málefni sem varða nánustu framtíð (t.d. nokkrir dagar eða vikur) ráða hegðun minni	☐	☐	☐	☐	☐
5. Mín þægindi skipta miklu máli í þeim ákvörðunum sem ég tek eða í því sem ég geri	☐	☐	☐	☐	☐
6. Ég er tilbúin/n til að fórna skammtíma ánægju minni og hamingju til þess að öðlast ávinninga í framtíðinni	☐	☐	☐	☐	☐
7. Ég tel það mikilvægt að taka viðvaranir um neikvæðar afleiðingar alvarlega, þrátt fyrir að afleiðingarnar komi ekki fyrr en eftir mörg ár	☐	☐	☐	☐	☐
8. Ég tel mikilvægara að hegðun stjórnist af alvarlegum afleiðingum í framtíðinni frekar en af léttvægari afleiðingum í nútíðinni.	☐	☐	☐	☐	☐
9. Ég hunsa venjulega viðvaranir um vandamál sem kynnu að verða í framtíðinni því ég held að vandamálin leysist áður en þau verða ógnvekjandi	☐	☐	☐	☐	☐
10. Það er óþarfi að fórna líðandi stundu því vandamál framtíðarinnar leysast seinna	☐	☐	☐	☐	☐
11. Mínar athafnir miðast við það sem þarf að sinna strax, því ég mun geta tekið á vandamálum framtíðarinnar seinna.	☐	☐	☐	☐	☐
12. Þar sem dagleg verk mín hafa vel skilgreindar afleiðingar eru þau mikilvægari heldur en hegðun sem hefur fjarlægar afleiðingar	☐	☐	☐	☐	☐
13. Þegar ég tek ákvörðun tek ég til greina hvaða afleiðingar hún kynni að hafa fyrir mig í framtíðinni	☐	☐	☐	☐	☐
14. Yfirleitt hafa framtíðarafleiðingar áhrif á hegðun mína	☐	☐	☐	☐	☐

Appendix IV – CFC items (English)

[(I) denotes CFC-immediate items and (F) CFC-future items]

1. I consider how things might be in the future, and try to influence those things with my day to day behavior. (F)

2. Often I engage in a particular behavior in order to achieve outcomes that may not result for many years. (F)

3. I only act to satisfy immediate concerns, figuring the future will take care of itself. (I)

4. My behavior is only influenced by the immediate (i.e., a matter of days or weeks) outcomes of my actions. (I)

5. My convenience is a big factor in the decisions I make or the actions I take.(I)

6. I am willing to sacrifice my immediate happiness or well-being in order to achieve future outcomes. (F)

7. I think it is important to take warnings about negative outcomes seriously even if the negative outcome will not occur for many years. (F)

8. I think it is more important to perform a behavior with important distant consequences than a behavior with less important immediate consequences. (F)

9. I generally ignore warnings about possible future problems because I think the problems will be resolved before they reach crisis level. (I)

10. I think that sacrificing now is usually unnecessary since future outcomes can be dealt with at a later time. (I)

11. I only act to satisfy immediate concerns, figuring that I will take care of future problems that may occur at a later date. (I)

12. Since my day to day work has specific outcomes, it is more important to me than behavior that has distant outcomes. (I)

13. When I make a decision, I think about how it might affect me in the future.(F)

14. My behavior is generally influenced by future consequences.(F)

Appendix V – Some indicators considered for inclusion

Indicator	Source	Reason for rejection
Maternity leave laws, after Kasser (2011)	ILO	Despite being used elsewhere, there is little evidence linking this to the wellbeing of children, as opposed to parents.
Education spend (%GDP/c) per primary student	UNESCO	Not enough data points
School Attendance	UNESCO	Not enough differentiation in rich countries; statistics heavily skewed by repeat years, late entry etc.
Life Expectancy	World Bank	Not enough differentiation in rich countries; theoretically lacking as it describes current human capital rather than the next generation's.
Funding for health care as % of GDP/c	Various	Lack of centralised data on public/private spending splits; theoretically may relate exclusively to disproportionate investment in current generations e.g. healthcare for the elderly
State spending on the old vs. the young after Vanhuysse (2013)	Various	Not enough data; may relate more to differences in pension funding mechanisms
Deforestation rate	FAO	Unreliable; superseded by satellite data
Consumption CO_2 per capita	Footprint of Nations	Not enough data points
Gross Capital formation	World Bank	Not as precise as Adjusted Net Savings
Gross Savings	World Bank	Not as precise as Adjusted Net Savings
Central Government Debt	World Bank	Not an indicator of short-termism (see Economics section) and non-comparable between federal and non-federal countries

Income Inequality (Gini)	World Bank	Wealth inequality is more relevant
Research & Development Budget	World Bank	Non-comparable data due to differences in public/private investment
Advertising to Children	Various	Not enough data points
Social Discount Rate	Various	Not enough data points
Household Debt	Various	Not enough data points
Pension spending/deficit by central government	Various	Non-comparable data due to differences in public/private investment; not enough data points
United Nations Voluntary Contributions (%GDP/c)	U.N.	Inadequate data; U.N. funding is generally progressive (even after corrections for GDP)
Child Wellbeing	UNICEF	Not enough data points
Status of tobacco	Various	Too much variation in policies
Soil erosion/land degradation	FAO	Not enough time-series data points (1991 only); doubts about accuracy; much reflects semi-natural change (e.g. desertification)

Appendix VI – Full table of indicator and index scores

	Forest Degradation	Carbon Footprint	Low-Carbon Energy	Environmental Average	Inequality	Current Account Balance	Adjusted Net Savings	Economic Average	Pupil-Teacher Ratio	Child Mortality	Fertility	Social Average	Index Average	Rank
Norway	82	75	61	72	39	100	88	70	100	83	96	93	78	1
Costa Rica	68	86	59	70	41	58	75	56	76	91	91	86	70	2
Vietnam	64	100	21	51	57	100	76	76	73	82	86	80	68	3
Slovenia	90	23	51	47	71	100	54	73	85	100	82	89	67	4
Sweden	59	22	67	44	37	100	91	70	100	100	88	96	67	5
Nepal	96	100	16	54	53	100	100	81	38	88	82	65	66	6
Lithuania	73	46	43	52	55	100	36	58	91	90	89	90	65	7
France	86	30	68	56	51	85	46	59	79	92	81	84	65	8
Hungary	100	43	40	56	58	100	37	60	99	89	61	81	65	9
Sri Lanka	83	100	20	55	55	58	92	67	66	100	59	73	64	10
China	75	50	19	42	48	100	100	78	80	77	87	81	64	11
New Zealand	100	50	54	65	50	70	36	50	86	72	86	81	64	12
Switzerland	92	18	63	47	36	100	87	68	98	67	74	78	63	13
Belgium	73	21	46	41	60	93	50	66	97	83	98	92	63	14
Korea, Rep.	83	22	41	42	45	100	100	77	64	100	57	72	61	15
Bulgaria	99	40	48	58	56	82	37	55	83	62	76	73	61	16
Tajikistan		100	76	87	60	60	41	53	68	74	23	49	61	17
Germany	81	26	36	42	41	100	64	64	92	87	65	80	60	18
Peru	82	100	32	64	33	74	66	55	72	54	60	61	60	19
Philippines	81	100	49	74	30	100	100	67	40	50	40	43	60	20
Finland	54	17	45	34	49	100	52	63	88	100	96	95	59	21
Spain	90	32	40	49	55	74	34	52	92	91	57	78	58	22
Croatia	96	35	24	43	56	88	29	52	86	100	75	86	58	23
Austria	68	21	33	36	39	100	71	65	95	82	68	81	58	24
Netherlands	83	26	14	31	47	100	66	68	96	76	96	89	57	25
Latvia	33	55	25	35	54	100	56	67	95	72	68	78	57	26
Japan	94	25	38	45	60	100	21	50	79	100	69	82	57	27
Uruguay	100	86	38	69	40	66	18	36	81	60	81	73	57	28
Ireland	100	19	15	30	49	100	60	67	83	83	83	83	55	29
El Salvador	50	100	58	66	47	59	34	45	29	81	73	56	55	30
Czech Republic	90	23	41	44	40	77	28	45	81	100	72	83	55	31
United Kingdom	89	25	30	40	53	72	26	46	81	77	90	82	54	32

Romania	90	60	34	57	46	63	25	41	83	45	74	65	54	33
Italy	94	29	24	40	56	85	18	44	99	97	66	85	53	34
Ecuador	78	100	27	59	43	92	32	51	73	33	55	51	53	35
Brazil	52	100	39	59	32	76	23	38	70	46	92	67	53	36
Denmark	66	30	19	34	21	100	58	49	98	88	82	89	53	37
Thailand	75	75	8	35	32	100	70	61	83	64	64	70	53	38
Canada	63	18	47	38	47	68	41	51	85	66	76	75	52	39
Venezuela, RB	83	43	32	49	33	100	54	56	78	29	61	52	52	40
Macedonia, FYR	75	30	21	36	52	68	31	48	80	97	67	81	52	41
Estonia	48	35	6	22	53	100	66	71	96	100	70	88	51	42
Malaysia	28	55	9	24	35	100	85	67	87	77	90	84	51	43
Australia	100	25	12	31	59	60	36	51	86	79	88	84	51	44
Indonesia	45	100	28	51	29	94	100	65	79	12	65	40	51	45
Russian Federation	84	25	29	39	20	100	51	46	81	42	86	66	49	46
Iceland		75	91	82	53	82	0	16	100	100	72	90	49	47
Ukraine	82	50	43	56	16	45	22	25	83	100	69	83	49	48
Mexico	68	32	25	38	42	88	51	57	55	36	74	52	48	49
Bangladesh	72	100	5	32	54	100	100	81	14	70	80	42	48	50
Poland	95	32	6	26	44	62	45	50	99	98	64	85	48	51
Israel		26	21	24	40	100	70	65	92	98	36	69	47	52
Slovak Republic	70	33	50	49	80	90	4	30	84	68	66	72	47	53
Morocco	100	100	11	48	38	29	100	48	58	32	40	42	46	54
Colombia	76	100	35	65	41	72	5	25	55	52	67	57	45	55
Armenia	98	100	56	82	59	0	38	13	75	84	92	83	45	56
Argentina	10	86	25	27	35	100	30	47	84	44	72	64	44	57
Cyprus	84	26	16	33	35	35	17	28	86	100	69	84	42	58
Chile	100	100	25	63	38	91	0	15	62	80	97	78	42	59
Bolivia	54	100	18	46	44	100	20	45	65	18	36	35	41	60
Azerbaijan	96	86	14	48	58	100	57	69	94	0	95	21	41	61
United States	59	14	34	30	28	72	29	39	90	20	91	55	40	62
Tunisia	100	100	4	33	45	37	12	27	79	62	64	68	39	63
Egypt, Arab Rep.		100	13	37	35	78	18	37	62	30	46	44	39	64
Albania	64	100	45	66	55	0	26	11	75	72	92	79	39	65
Kyrgyz Republic	97	100	60	83	58	0	25	11	64	95	29	56	38	66
Paraguay	0	100	100	22	43	100	18	43	60	62	44	55	37	67
Haiti	73	100	7	38	41	61	68	55	10	39	35	24	37	68
Panama	59	60	32	48	39	5	100	27	65	14	58	37	36	69
Mauritius	100	43	29	50	45	3	31	15	71	44	61	57	35	70
Kenya	61	100	27	55	50	30	33	37	16	20	20	19	34	71
India	84	100	16	51	34	68	95	60	29	0	62	12	33	72
Portugal	45	32	27	34	50	42	0	13	97	100	64	85	33	73
Pakistan	89	100	20	56	61	86	48	63	27	0	41	10	33	74
Senegal		100	8	28	55	36	45	45	32	52	15	29	33	75
Jordan		75	13	31	56	4	54	24	75	40	34	47	33	76
Greece	72	27	17	32	54	34	0	12	97	96	70	87	32	77
Namibia		100	29	54	31	64	65	51	45	0	41	12	32	78
Turkey	93	55	24	49	29	36	40	35	75	0	84	18	32	79
Algeria	76	100	3	27	54	100	100	82	64	0	40	14	31	80
Belarus	97	35	1	16	58	1	96	18	86	100	93	93	29	81

Burkina Faso		100	21	46	55	67	34	50	4	28	13	11	29	82
Rwanda	90	100	27	62	48	19	30	30	0	88	19	12	28	83
Congo, Dem. Rep.	76	100	17	51	53	32	0	12	32	73	12	31	26	84
Ethiopia	84	100	11	45	61	56	11	34	0	86	20	12	26	85
Lao PDR	57	100	93	81	59	78	0	17	51	0	44	13	26	86
Togo	78	100	6	35	57	41	0	13	27	62	18	31	24	87
Lesotho		100	74	86	46	0	73	15	30	0	45	11	24	88
Bahrain		11	0	3	56	100	58	69	95	32	83	63	24	89
Nicaragua	0	100	32	15	49	0	66	15	44	86	58	60	24	90
Jamaica	66	75	7	33	41	0	28	6	60	70	69	66	23	91
Singapore		14	0	2	48	100	100	78	77	85	57	72	23	92
Nigeria	79	100	7	37	36	100	24	44	27	0	11	7	22	93
Liberia	69	100	0	19	57	0	31	12	58	100	17	46	22	94
Lebanon	98	38	11	34	26	0	0	3	89	76	69	77	20	95
Botswana		60	0	8	37	81	100	67	61	0	55	15	20	96
South Africa	100	38	16	39	33	61	1	14	47	0	63	14	20	97
Ghana	52	100	24	50	55	5	12	15	44	0	27	11	20	98
Sudan		100	14	37	59	39	4	20	42	0	21	10	19	99
Cameroon	89	100	23	59	54	63	4	24	6	0	18	5	19	100
Cote d'Ivoire	8	100	12	21	48	100	22	47	16	0	16	6	19	101
Malawi	21	100	71	53	55	0	21	11	0	99	13	11	18	102
Kazakhstan	98	22	10	28	24	100	0	13	83	0	50	16	18	103
Tanzania	60	100	11	40	58	0	67	16	0	60	13	9	18	104
Guinea	64	100	46	66	56	0	0	4	14	46	17	23	18	105
Saudi Arabia		25	0	5	40	100	66	64	97	0	53	17	18	106
Angola	76	100	15	49	43	100	0	16	17	0	14	6	17	107
Qatar		8	0	3	47	100	100	78	97	0	91	21	17	108
Benin		100	0	10	56	18	23	28	6	37	17	16	16	109
Mali		100	51	71	56	13	21	25	0	0	9	2	15	110
Cambodia	0	100	3	7	55	42	17	34	0	76	45	15	15	111
Kuwait		8	0	3	44	100	67	67	100	0	49	17	15	112
Trinidad and Tobago	65	9	0	8	49	100	0	17	82	0	95	20	14	113
Burundi	72	100	51	72	59	0	0	4	0	92	11	10	14	114
Niger		100	0	10	56	0	31	12	24	64	7	22	14	115
Uganda	36	100	51	57	53	2	0	4	1	63	11	9	13	116
Sierra Leone	66	100	29	58	56	0	0	4	45	0	22	10	13	117
Mozambique	35	100	38	51	51	0	0	4	0	73	15	10	12	118
Guinea-Bissau	58	100	0	18	59	40	0	13	0	11	18	6	11	119
Mongolia	0	50	0	4	59	0	8	8	47	18	54	36	10	120