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The Unintended Consequences of Paradigm Death and Shift: Was the Arrow Impossibility Theorem Left Behind?

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Abstract

When paradigm shift takes place the knowledge base of the old paradigm is left behind. If an axiom is proven true, everything derived from that axiom is true. If an axiom is proven false, everything supported by that axiom is false. When there is a paradigm shift, the axiom that was true in the previous paradigm is false in the new paradigm and therefore, everything derived from old paradigm to be applied in the new paradigm is false as now there is a paradigm shift knowledge gap. And if the knowledge base of the old paradigm is used in the new paradigm then you create a theory-practice inconsistency. Hence new paradigms require either a new axiom or a fixed old axiom; and this leads to a house of cards fall down effect: the main card/Axiom falls and the other cards on the top of it fall because the paradigm has shifted. In other words, when a paradigm shifts it leaves the previous knowledge base behind, creating a knowledge fall down effect reflected in the paradigm shift knowledge gap. And this situation is consistent with paradigm refutation a la Karl Popper as the old paradigm and its knowledge base is left behind and a paradigm shift knowledge gap is created; and it is also consistent with the growth of knowledge a la Thomas Kuhn as this knowledge gap must be closed with new ideas or with fixed old ideas. Among the goals of this paper are: a) to share a general choice or preference framework that can be linked to independent, partially co-dependent, and fully codependence assumptions; and b) to use the case of the Arrow Impossibility Theorem as one unintended consequence of paradigm shift to show that the paradigm shift from an independent choice model (the traditional market) to a partially codependent choice model(the green market) has left it behind as part of the house of cards fall down effect.

Keywords: Paradigm death, paradigm shift, Arrow impossibility theorem, knowledge gap, knowledge fall down effect, house of cards fall down effect, paradigm shift knowledge gap, independent choice, partially codependent choice, fully codependent choice.

Introduction

a) Paradigm evolution

From time to time paradigms change structure either because of internal paradigm dynamics or external paradigm dynamics as any of them can lead to paradigm death and shift, details and examples of this are given below:

i) Internal paradigm dynamics

When evidence for change accumulates and win-win situations are identified between dominant and dominated components of a system then mainstream thinkers in that paradigm may decide the type of shift that takes place. This type of paradigm shift may or may not reflect the actual needs for paradigm change. For example, in 1987 the Bruntland Commission called for closing social and environmental sustainability gaps to make the traditional market more inclusive(WCED 1987), but in 2012 RIO + 20 a model based on closing the environmental sustainability gap only was chosen as the formal substitute of the Adam Smith's traditional market(UNCSD 2012a; 2012b); and therefore we now live formally under rules of green markets.

Hence development today is not about pure growth, but about green growth(OECD 2011), that is inclusive(WB 2012), global worming friendly(UNFCCC 2015), and therefore the focus now is on low carbon(UN 2012) and resilient development(WB 2015) as the best way to meet 17 different sustainable development goals(UN 2015a; 2015b). How Adam Smith created these social and environmental sustainability gaps that now need to be corrected when simplifying reality to make it a market run only reality to state the traditional market model was recently highlighted(Muñoz 2015).

ii) External paradigm dynamics

When opposing paradigms clash they remain in clash positions for long time in what is usually known as cold wars such as the recent clash between two opposing paradigms, red socialism and bare capitalism. Paradigm clashes can induce paradigm death and shift in two ways: a) forcing paradigm death and shift when there are no win-win situations, and b) forcing paradigm death, merger, and shift when they find win-win situations.

For example, the clash of paradigms mentioned above led to the death of Karl Marx's model and brought down the red socialist system in 1991 under no win-win conditions and led to China shifting paradigm from red socialist to socio-capitalist under win-win conditions(Muñoz 2010a). The newest members of the capitalist family are now China and its state controlled capitalism(Coase and Wang 2013) and all the former soviet bloc countries who moved to creating working economies after the collapse of communism(Shleifer and Treisman 2014]), including Russia(Clarke 2006; Djankov 2015).

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b) The house of cards effect

When paradigm shift takes place the knowledge base of the old paradigm is left behind. If an axiom is proven true, everything derived from that axiom is true. If an axiom is proven false, everything supported by that axiom is false. When there is a paradigm shift, the axiom that was true in the previous paradigm is false in the new paradigm and therefore, everything derived from old paradigm to be applied in the new paradigm is false as now there is a paradigm shift knowledge gap. And if the knowledge base of the old paradigm is used in the new paradigm then you create a theory-practice inconsistency. The above holds for any paradigm shift including the shift from the traditional market model of Adam Smith(T = aBc) to the green market model(GM = aBC). The paradigm dynamics and theory behind paradigm shifts in general as well the paradigm structure before and after the shift from traditional markets to green markets have been recently pointed out(Muñoz 2016).

Hence new paradigms require either a new axiom or a fixed old axiom; and this leads to a house of cards fall down effect: the main card/Axiom falls and the other cards on the top of it fall because the paradigm has shifted. In other words, when a paradigm shifts it leaves the previous knowledge base behind, creating a knowledge fall down effect reflected in the paradigm shift knowledge gap as it can be seen in Figure 1 below in the case of the Traditional Market model:

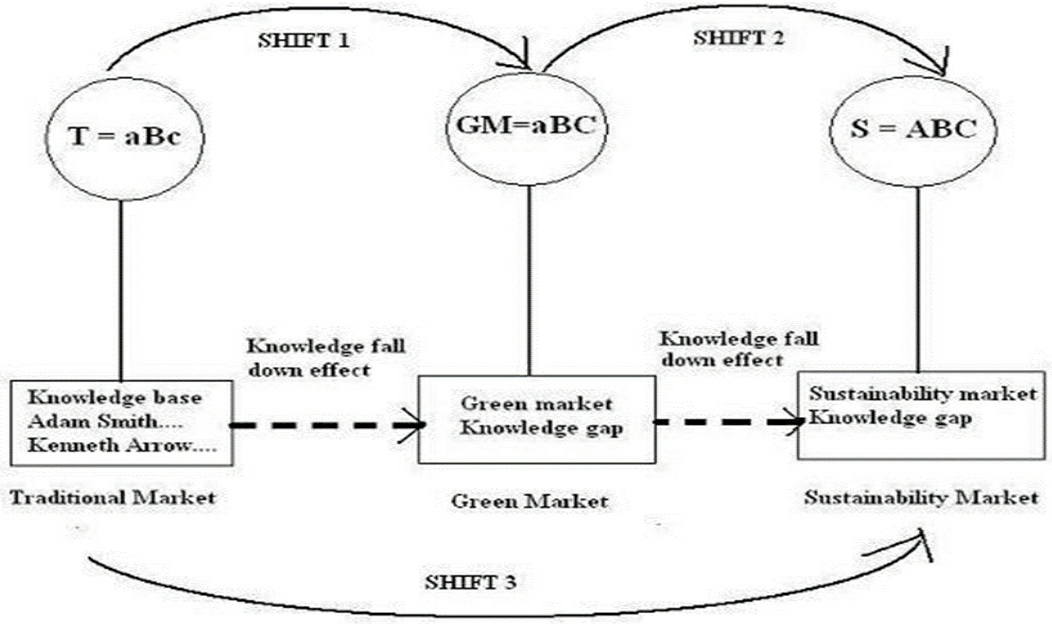

Figure 1 Paradigm shifts, knowledge fall down effect, knowledge gaps

Notice the following about the situation depicted in Figure 1 above:

i) it is consistent with paradigm refutation a la Karl Popper(Popper 1965) as the old paradigm of Adam Smith and its knowledge base is left behind and a paradigm shift knowledge gap is created as it is refuted either based on environmental observation only(e.g. pollution, degradation) and shifting to green markets(GM) or based on both social observations(e.g. poverty, inequality) and environmental observations(e.g. pollution, degradation) at the same time and shifting to sustainability markets(S) ; and

ii) it is consistent with the growth of knowledge a la Thomas Kuhn(Kuhn 1970) as those knowledge gaps must be closed with new ideas or with fixed old ideas contributing this way to the growth of scientific knowledge.

Based on Figure 1 above the following three things can be said:

i) that when we shifted from the traditional market(T) to the green market(GM) as indicated by arrow Shift 1 we left the knowledge base of the traditional market behind leading to the knowledge fall down effect captured by the green market knowledge gap. If the Adam Smith's card needs to be fixed everything build on it like the Arrow Impossibility Theorem, Singular welfare function theories and so on…..need to be fixed or evolve. There is a knowledge fall down effect as it will take time to create new green market knowledge or to correct the old traditional market knowledge making the transition to the green economy more difficult. For example micro-economics and macro-economics need to be updated to green micro-economics and green macro-economics for them to be able to support green markets and respect the theory-practice consistency principle. Therefore, we seem to be approaching sustainability backwards in terms of economic thinking(Muñoz 2012).

In the meantime, we are implemented global programs through green markets currently under this deep knowledge gap;

ii) that if we were to shift from the green market(GM) to the sustainability market(S) any time soon as indicated by arrow Shift 2 we would be going from a green market knowledge gap to a sustainability market knowledge gap

adding to the green market fall down effect the sustainability market fall down effect and making this way the transition more difficult. Therefore, correcting the traditional market first and then correcting the green markets means we were and are still living under distorted markets(Muñoz 2010b); and

iii) that if we would have shifted from the traditional market model(T) to the sustainability market(S) as indicated by arrow Shift 3 we would have left behind too the knowledge base of the traditional market leading to a another type of knowledge fall down effect captured by the sustainability market knowledge gap. So it would be wise to know as much as possible about sustainability markets in case we need to shift there in the future and minimize this knowledge fall down effect as much as possible. It has been stressed recently that paradigm evolution appears be leading towards sustainability as the final paradigm destination(Muñoz 2013)

And we can also notice in Figure 1 above two things:

i) that paradigm are shifting from left to right from points of more unsustainability to points of less or not unsustainability; and

ii) paradigm shift is taking place right now step by step from models of independent choice(T) to models of partial codependent choice(GM) to models of fully codependent choice(S) or it could have been one big step shift from models of independent choice(T) to models of full codependent choice(S).

c) The unintended consequences of paradigm shift

No much is written about what happens when paradigm shifts take place especially from the sustainability point of view, for example what happens to their original structure, to their continuity, and to their knowledge base. As indicated Figure 1 above, the original structure is lost forever when the shift takes place, their continuity is suddenly stopped when the old paradigm dies; and their knowledge base is left behind by the distance of the paradigm shift knowledge gap that is created when the shift takes place.

For example, when the traditional market of Adam Smith shifted towards the green market(1987-2012) the system structure and its choice structure; and the theories and methodologies based on Adam Smith's model, which are part of its knowledge base, were left behind. Among the goals of this paper are: a) to share a general choice or preference framework that can be linked to independent, partially co-dependent, and fully codependence assumptions; and b) to use the case of the Arrow Impossibility Theorem as one unintended consequence of paradigm shift to show that the paradigm shift from an independent choice model (the traditional market) to a partially codependent choice model(the green market) has left it behind.

Goals of This Paper

This paper has four goals:

i) to share a general choice or preference framework and link it to independent, partially co-dependent, and fully codependence assumptions;

ii) to use this framework to highlight the structure of each the choice paradigm created when implementing each specific assumption and link them to the Arrow Impossibility Theorem preference structure;

iii) to highlight that when paradigm shift takes place the previous assumptions and knowledge base are rendered invalid and they will need to be updated to become useful again or new knowledge needs to be created; and

iv) to use the case of the Arrow Impossibility Theorem as one unintended consequence of paradigm shift to show that the paradigm shift from an independent choice model(the traditional market) to a partially codependent choice model(the green market) has left it behind as part of the house of cards fall down effect.

Methodology

First, the terminology used in this paper is shared. Second some merging rules and operational concepts are given. Third, the general preference or choice model is introduced and used to derive choice paradigms under assumptions of independence, partial codependence, and full codependence linking them to the arrow impossibility theorem idea. Fourth, the unintended consequences of shifting paradigms are highlighted focused on before and after structures to show when the arrow impossibility theorem world was left behind as part of the house of cards fall down effect.

Fifth, the one to one shifting relationship between paradigm structure and choice structure before and after paradigm shifts is indicated together with the shifting tendency they display shifting from paradigm structures and choice structures going from less unsustainable to more sustainable structures. Sixth, based on the discussion above the structure of the economic man, the green economic man, and the sustainability man are highlighted with the help of Table 1 And finally some food for thoughts and relevant conclusions are provided.

Terminology

A = Active social system	a) Passive social system
B = Active economic system	b) Passive economic system
C = Active environmental system	c) Passive environmental system
V = Vanilla choice	C = Chocolate choice

F = Strawberry choice	VC = Vanilla-chocolate, mixed choice
VF = Vanilla-strawberry, mixed choice	CF = Chocolate-strawberry, mixed choice
VCF = Vanilla-chocolate-strawberry, fully mixed choice.	
T = Traditional market	GM = Green market
K = Deep social paradigm	EC = Deep ecological paradigm
SEM = Socio-economic model	SEC = Socio-ecological paradigm
S = Sustainability market	EE = Eco-economic market

Paradigm Merging Rules

If "A" and "B" are dominant characteristics; and "a" and "b" are their dominated or passive counter parts, the following is expected:

a) Merging under dominant-dominant interactions Under these conditions, dominant or active state prevails as indicated:

(AA) → A (BB) → B (AA) (BB) = (AB)(AB) → AB

b) Merging under dominated-dominated interactions

Under these conditions, the dominated or passive form prevails as shown:

(aa) → a (bb) → b (aa) (bb) = (ab)(ab) → ab

c) Merging under dominant-dominated interactions and win-win solutions

Under these conditions, the dominant or active system prevails as the system merge as shown below:

(Aa) → A (bB) → B (Aa) (bB) = (AB)(ab) → AB

d) Merging under dominant-dominated interactions and no win-win solutions

Under these conditions, the dominated or passive system prevails and the system collapses as shown below:

(Aa) → a (bB) → b (Aa) (bB) = (AB)(ab) → ab

e) Transforming models from additive form to system form

K = A + B + C--------→ K1 = ABC

R = a + B + c----------→R1 = aBc

f) Transforming system models into additive form

K1 = ABC----------→ K = A + B + C

R1 = aBc----------→ R = a + B + c

g) Fully closing gaps in additive systems

R = a + B + c----------→R1 = A + B + C

R2 = A + B + c---------→ R3 = A + B + C

h) Fully closing gaps in system thinking

R = aBc-------→R1 = ABC

R2 = ABc----→ R3 = ABC

Operational Concepts

To present the views in this paper and link them later to a preference framework usually used to share the ideas of the Arrow Impossibility Theorem we are going to use the terms Vanilla(V), Chocolate(C), and Strawberry(F) as choices that can exist in independent form, partially mixed or codependent form, and fully mixed or full codependent form:

a) Types of choices

i) Fully independent choices, when we have individual choices unrelated to each other or pure choices such as Vanilla(V), chocolate(C), and strawberry(F). In this world only fully independent choices exist so the set = {V, C, F}.

ii) Partially codependent choices, when we have mixed/paired choices such as Vanilla-chocolate(VC), vanilla-strawberry(VF), and chocolate-strawberry(CF). In this universe only codependent choices exist so the set = {VC, VF, CF}.

iii) Fully codependent choices, when all choices are mixed together such as vanilla-chocolate-strawberry(VCF). In this paradigm only fully codependent choices exist so the set = {VCF}.

b) Types of system structures

i) Fully independent systems, they are deep paradigm systems such as the deep social model(K = Abc), the deep economic model(T = aBc), the deep ecological model(EC= abC). In deep systems only independent choices work. It is know that under deep social systems choices in theory could have been fully independent, but in practice they were not. We can see also that independent choices would work also in deep ecological systems, but they never existed. So only the deep economic model is the fully independent system ruled by independent choices, and the Arrow Impossibility

Theorem and theory holds here. Therefore, the traditional market model(T = aBc) is the first model relevant in this paper.

ii) Partially codependent systems, they are systems based on partnership thinking such as the socio-economic market(SEM = ABc), the green market model(GM = aBC), and the socio-ecological model(SEC =AbC). In partnership paradigms only partially codependent choices work. Today it seems that only the socio-economic partnership like the one in China and in the former soviet states; and the eco-economic or green market partnership like the green market in old capitalist countries are viable, not example seems to exist of socio-environmental partnership that would be viable as they assume economic externality neutrality. The eco-economic or green market partnership(GM = aBC) is the second model relevant in this paper.

iii) Fully codependent systems, they are systems based on full inclusion such as the sustainability market model(S = ABC). This market does not exist yet, but it is in our paradigm shift route. Therefore, the sustainability market(S = ABC) is the third model relevant for this paper.

c) Linking rationality, choices and system structures

i) Rational independent decision makers, they are created when we put fully independent choices together with fully independent systems. For example under the traditional market(T) we have the rational independent decision maker known as the economic man, who incorporates independent sets of choices such as {V, C, F} in his decision making process. See that independent choices(independent choice structure such as {V, C, F}) go with independent deep systems(independent system structure such as T = aBc) to keep intact the theory-practice consistency principle. The use of any type of none fully independent choice would violate the theory-practice consistency principle.

ii) Rational partially codependent decision makers, they are created when we put partially codependent choices together with partially codependent systems. For example under the green market we have the rational codependent decision maker now known as the green economic man, who incorporates partially codependent sets of choices such as {VC, VF, CF} in his decision making process. See that partially codependent choices(partially codependent choice structure such as {VC, VF, CF}) go with partially codependent systems(partially codependent system structure such as GM = aBC) to keep intact the theory-practice consistency principle. The use of any type of none partially codependent choice would violate the theory-practice consistency principle.

iii) Rational fully codependent decision makers, they are created when we put fully codependent choices together with fully codependent systems. For example under the sustainability market we have the rational fully codependent decision maker now known as the sustainability man, who incorporates fully codependent sets of choices such as {VCF} in his decision making process. See that fully codependent choices(fully codependent choice structure such as {VCF}) go with fully codependent systems(fully codependent system structure such as S = ABC) to keep intact the theory-practice consistency principle. The use of any type of none fully codependent choice would violate the theory-practice consistency principle.

The General Choice Model(w)

Let's assume that we live in a world(W) where Vanilla(V), Chocolate(C), and Strawberry(F) can be found in pure forms({V, C, F}), in partially mixed forms({VC, VF, CF}) and in fully mixed forms({VCF}), which can be expressed as shown below:

W = V + C + F + VC + VF + CF + VCF

The general choice model(W) above says that all those choices are available to us at the same time and each of us could express individual preferences and they could be aggregated to determine social preferences.

i) The independent choice paradigm(IW)

In we subject the general model W above to the independent assumption, only pure independent choices are available, then it get transformed into an independent choice world(IW) as indicated below:

IW = V + C + F

If we have 3 groups of people X, Y and Z to rank the choices we would end up in the irrational situation associated with the world of the Arrow Impossibility Theorem if X prefers V, if Y prefers F, and if Z prefers C as shown in Table 1 below:

Table 1: Ice Cream Choices as Independent Choice

Groups	Independent choices		
	V	**C**	**F**
X	1	2	3
Y	2	3	1
Z	3	1	2

The information in the table 1 above describes a situation where V is preferred to F, F is preferred to C, and C is preferred to V, an irrational situation from the independent choice point of view, which falls inside the Arrow Impossibility Theorem world as we are dealing with individual preferences.

Notice that independent choices like the ones above are the type of choices under which the traditional market model worked as the economic man was assumed to be a rational independent decision maker able to rank independent choices and this falls into the domain of the Arrow Impossibility theorem and assumptions to aggregate

individual independent preferences into social preferences. So here these three groups X, Y, and Z are choosing from independent choices. And having those three independent choices individual preferences can be aggregated to generate a singular welfare function for the deep model.

ii) The partially codependent paradigm(PCW)

In we subject the general model W above to the partially codependent assumption, only partial codependent choices are available, then it gets transformed into a partially codependent choice world(PCW) as indicated below:

PCW = VC + VF + CF

If we have 3 groups of people X, Y and Z to rank the choices we would end up in the world parallel to the world of the Arrow Impossibility Theorem if X prefers VC, if Y prefers CF, and if Z prefers VF as indicated in table 2 below:

Table 2: Ice Cream Choices as Partially Mixed or Partially Codependent Choice

Groups	Partial Codependent choices		
	VC	VF	CF
X	1	2	3
Y	2	3	1
Z	3	1	2

The information in the Table 2 above describes a situation where VC is preferred to CF, CF is preferred to VF, and VF is preferred to VC, an irrational situation from the partially codependent choice point view, which falls outside the standard Arrow Impossibility Theorem view: Now we are not dealing with individual preferences, but partially codependent preferences.

Partially codependent choices like the ones described above are the type of choices taking place in partnership paradigms like the eco-economic market or green market as the green economic man is a rational partially co-dependent decision maker able to rank partially codependent choices. Aggregation of partially codependent choices falls outside the standard world of the Arrow Impossibility Theorem. Therefore, here X, Y and Z are choosing from partially codependent choices. And having those three partially co-dependent choices individual preferences can be aggregated to generate a partially non-singular welfare function for the partnership.

iii) The totally codependent paradigm(FCW)

In we subject the general model W above to the fully codependent assumption, only fully codependent choices are available, then it gets transformed into a fully codependent choice world(FCW) as indicated below:

FCW = VCS

If we have 3 groups of people X, Y and Z and only one choice we would end up in a world totally different than the standard world of the Arrow Impossibility theorem as everyone prefers the same choice as indicated in Table 3 below:

Table 3: Ice Cream Choices as Fully Mixed or Fully Codependent Choice

Groups	Fully Codependent choices		
		VCF	
X		1	
Y		1	
Z		1	

The information in the Figure 4 above describes a situation where VCF is preferred by everybody X, Y, and Z , a rational situation that falls outside the standard world of the Arrow Impossibility Theorem: Now we are not dealing with individual preferences, but fully codependent preferences.

Notice that choices in sustainability markets, which do not exist yet, have that type of fully codependent choice structure as the sustainability man is a rational fully codependent decision maker always preferring totally inclusive choices. So in this model group X, Y and Z all prefer the same fully codependent choice. And having those three fully codependent choices individual preferences can be aggregated to generate a fully non-singular welfare function for the sustainability market.

The Unintended Consequences of Shifting Paradigms

When paradigms shift they leave the knowledge base of the old paradigm behind, a situation that was highlighted graphically in Figure 1 above. Below is a detailed description of what happens when paradigm shifts analytically to the Arrow Impossibility Theorem in particular and to the knowledge base of the traditional market in general.:

i) The paradigm shift from independent choices toward partially codependent choices

The structure of this paradigm shift in terms of shift in the choice structure(IW----→PCW) and shift in the system structure(T------→GM) can be stated as below:

Before the shift **After the shift**

---

1) IW = V + C + F----------→ PCW = VC + VF + CF

2) T = a + B + c----------→ GM = a + B + C

3) T = aBc----------→ GM = aBC

Arrow impossibility Outside the normal Arrow

Theorem world impossibility theorem world

Notice that the before the shift the structure of choices in 1) and the structure of models in 2) and 3) are independent; and after the shift the structure of choices in 1) and the structure of models in 2) and 3) are partially codependent. Therefore, after the shift the traditional market of Adam Smith(T) loses its choice structure and its model structure and the green market(GM) is borne under a paradigm shift knowledge gap. You can see that before the shift the arrow impossibility theorem holds, but after the shift the new paradigm choice and model structure falls outside the standard view of the Arrow impossibility theorem.

You can see too that before the shift model 2) and 3) can be maximized, but after the shift they cannot be maximized, they must be partially optimized or jointly maximized. Notice that the implications of the choice and model structures after the shift or the paradigm shift knowledge gap affects not just Arrow Impossibility theorem and theory, but all the knowledge base supported on the traditional market(T)'s world.

ii) The paradigm shift from partially codependent choices toward fully codependent choices

The structure of this paradigm shift in terms of shift in the choice structure(PCW---→FCW) and shift in the system structure(GM----→S) can be stated as follows:

Before shift **After shift**

---

4) PCW = VC + VS + CS----------→ FCW = VCS

5) GM = a + B + C----------→ S= A+ B + C

6) GM = aBC----------→ S = ABC

Outside the normal world Outside the world of the arrow

Of Arrow Impossibility impossibility theorem

Theorem

Notice that the before the shift the structure of choices in 4) and the structure of models in 5) and 6) are partially codependent; and after the shift the structure of choices in 4) and the structure of models in 5) and 6) are fully codependent. Therefore, after the shift the green market(GM) loses its choice structure and its model structure and the sustainability market(S) is borne under another paradigm shift knowledge gap.

You can see that before the shift the standard arrow impossibility theorem does not hold and after the shift the new paradigm choice and model structure also falls outside the standard view of the Arrow impossibility theorem. And you can notice too that before the shift model 5) and 6) can be jointly maximized or partially optimized, but after the shift they must be fully optimized. Notice that the implications of the choice and model structures before and after the shift or the paradigm shift knowledge gaps affect not just Arrow Impossibility theorem and theory, but all the knowledge base supported on the traditional market(T)'s world.

iii) The paradigm shift from independent choices toward fully codependent choices

The structure of this paradigm shift in terms of shift in the choice structure(IW----→FCW) and shift in the system structure(T----→S) can be stated as follows:

Before the shift **After the shift**

---

7) IW = V + C + S----------→ FCW = VCS

8) T = a + B + c----------→ S = A + B + C

9) T = aBc ----------→ S = ABC

The Arrow impossibility Outside the standard Arrow

Theorem world holds impossibility Theorem world

Notice that the before the shift the structure of choices in 7) and the structure of models in 8) and 9) are independent; and after the shift the structure of choices in 7) and the structure of models in 8) and 9) are fully codependent. Therefore, after the shift the traditional market of Adam Smith(T) loses its choice structure and its model structure and the sustainability market(S) is borne under another paradigm shift knowledge gap. You can see too that before the shift the arrow impossibility theorem holds, but after the shift the new paradigm choice and model structure falls outside the standard view of the Arrow impossibility theorem.

Also notice that before the shift model 8) and 9) can be maximized, but after the shift they cannot be maximized, they must be fully optimized. And notice too that the implications of the choice and model structures after the shift or the paradigm shift knowledge gap affects not just Arrow Impossibility theorem and theory, but all the knowledge base supported on the traditional market(T)'s paradigm.

In summary: The paradigm shift from the traditional market(T) to the green market(GM) left the knowledge base of the traditional market behind, including the Arrow Impossibility Theorem.

The One to One Relationship between Shift in Choice Structure and Shift in Paradigm Structure

Table 4 below summarizes the one to one relationship that exists in paradigm shifts in terms of shifting choice structures parallel to shifting paradigm structures:

Table 4: The One to One Relationship between Market Paradigm Shift and Choice

Markets	Choices		
	IW	PCW	FCW
T=aBc	1	0	0
GM=aBC	0	1	0
S=ABC	0	0	1

Notice the following in Table 4 above:

i) as models shift from traditional market(T) to green market(GM) to sustainability markets(S) the choice structure shift from independent world(IW) to partially codependent world(PCW) to fully codependent world(FCW);

ii) Paradigm structures and choice structures are moving from less sustainable forms to more sustainable forms; and

iii) the choice structure with the paradigm structure match one to one as shown by the 1 in the diagonal structure respecting the theory-practice consistency principle.

And also Table 4 above highlights

a) when paradigms shift the old paradigm loses its choice structure and its original model structure;

b) each paradigm structure requires a matching choice structure and it does not work under a different choice structure; and

c) as paradigm shifts from T to GM to S the previous choice structure no longer works and they take a compatible choice structured meeting at 1 along the diagonal of the Tables 4.

Highlighting the Personalities of the Decision Makers in Each Paradigm

Based on the information in Table 5 below and the discussion above we can stress the following:

i) The economic man in traditional market(T) is a rational independent and fully unfriendly man acting based on independent preferences and hence he falls within the world of the Arrow Impossibility Theorem;

ii) The green economic man in the eco-economic market or green market(GM) is a rational partially codependent and partially friendly decision maker acting based on partially codependent choices and therefore he falls outside the normal world of the Arrow impossibility theorem;

iii) The sustainability man in the sustainability market(S) is a rational fully codependent and fully friendly man acting based on fully codependent choices and because of that he does not fall within the normal domain of the Arrow Impossibility Theorem.

Table 5

	T = aBc	GM = aBC	S = ABC
Preferences	Independent	Partially codependent	Fully codependent
Rationality	Rational	Rational	Rational
Invisible hand	Fully unfriendly	Partially friendly	Fully unfriendly
The agent	The economic man	Green economic man	Sustainability man

Food for Thoughts

i) Given current trends in paradigm evolution shifting from deep systems to partnership based systems, will the sustainability market be one day the only global market?;

ii) If the traditional market of Adam Smith was distorted because it assumed social and environmental externality neutrality, is the green market a distorted market too as it assumes social externality neutrality?;

iii) Does the shift from the traditional market to the green market means the end of singular welfare functions?; and

iv) Can green markets be supported properly without green micro-economics and green macro-economics?

Conclusions

First, it was pointed out that when paradigms shift they leave the knowledge base of the old model behind losing their original structure in terms of paradigm and choice structure. Second it was highlighted that choice structures and paradigm structures shift together from less unsustainable forms to more sustainable ones. Third, it was stressed that when the traditional market died and shifted to the green market if left its knowledge base behind and one of the

unintended consequences, but part of the house of cards fall down effect is leaving the Arrow Impossibility theorem as we know it behind. And finally, it was highlighted that under partnership markets such as the green market and under sustainability market the normal world of the Arrow impossibility theorem no longer works.

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