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ACCESS TO FINANCE AND TECHNOLOGY ADOPTION PARADOX: THE CASE OF CONCENTRATED SOLAR TECHNOLOGY ADOPTION BY TEA FACTORIES RUN BY KTDA IN KENYA

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Abstract

This study sought to find out the extent to which access to finance could influence the adoption of CSPT by tea factories run by KTDA in Kenya. The study was grounded on the Commercial Financial Instruments for Renewable Energy model authored by Dr Peter Lindlein and Dr. Wolfgang Mostert for the World Bank's Initiative, "Financing Renewable Energies in International Financial Cooperation". The target population was all factory unit managers of the 66 tea factories under the management of KTDA. The study was a cross-sectional survey taking a quantitative approach with descriptive and inferential statistical outcomes. Data collection was done using a structured questionnaire and a binary logistic regression model was used to analyze the data. Access to finance model was found to be statistically insignificant in influencing the likelihood of the adoption of CSPT by tea factories managed by KTDA, with a Chi2 p-value of 0.6253. This led to the conclusion that there is no significant relationship between access to finance and adoption of CSPT among the Kenyan tea factories run by KTDA'. These findings contradict the Commercial Financial Instruments for Renewable Energy model that this study was based on, and the assumption and expectations of policy makers on the importance of access to finance in the adoption of new technologies. Access to financial resources is mostly considered a key initiative for any project, but empirical literature and findings of this study have largely shown that in solar energy technologies adoption projects this is not so.

Keywords: Concentrated solar power technology, Adoption, factory, Access to finance

1. INTRODUCTION

Tea has been a key economic and social driver of the Kenyan community. It has been the country's leading foreign exchange earner in the last ten years, attaining export earnings of about Kshs 105 billion in 2013, an improvement over the Kshs 33 billion in 2003 (KNBS, 2015). In 2014 tea exports generated 24% of Kenya's foreign exchange earnings and the sector employed

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120,000 workers in addition to the 600,000 small holders who grow tea. Tea production accounts for over 11 per cent of agriculture's share of Kenya's Gross Domestic Product (GDP). Tea is also a catalyst for rural development as it is grown in 15 counties across Kenya. The industry directly and indirectly is a source of livelihood for about five million people in Kenya, making it one of the corner stones in economic well-being for Kenyans. Tea is therefore a great contributor to the economic development in Kenya. This pivotal contribution of the tea subsector is threatened by the sub-sectors sources of heat energy that are expensive, that are getting depleted and that hamper the natural environment.

Energy is a crucial input for tea manufacture and energy costs constitute thirty percent (30%) of the total tea processing cost (Baruah, Punja & Rao, 2012). Over 90% of tea factory energy requirements are for process heat used in withering and drying (Kamau et al, 2015). Heat energy is used to remove moisture from the green tea leafs. It is also used to further dry the fermented teas. Over 80% of the energy requirement in tea processing is heat energy used to remove moisture from tea leaves during withering and also drying (Baruah et al, 2012). The Kenya Tea Development Agency (KTDA) runs 55 Kenyan tea companies that own 67 factories (Rawlins & Ashcroft, 2013). By 2013, majority of the factories managed by KTDA were complaining of high costs of fuel in their tea processing operations (Rawlins & Ashcroft, 2013). Most of the factories were using wood as their basic source of heat energy. This source of heat energy was faced with the challenge of depletion (as there were less and less trees and forests), and the prices of wood were also going up. A few of the factories were still using fuel oil which was even more expensive than wood fuel. Beyond the high costs of wood and oil fuels, they both were pollutants to the environment due to carbon emissions and also posed health hazards for workers in the factories. The two sources face the challenge of not being sustainable.

These energy sources fall short of the United Nations Vision of Sustainable Energy for All by 2030, that seeks to help reduce poverty and alleviate the conditions and standard of living for the most of the people in the world (IISD, 2014). This challenge threatens future survival of the tea industry, Kenya foreign exchange earnings and the earnings and livelihood of the 600,000 small scale tea farmers, whose 80% income is from tea.

The factories have been searching for more sustainable sources of energy.

One source that has been recommended by various sustainable energy experts for the industry is the concentrated solar power technology (CSPT) (Rawlins & Ashcroft, 2013). This technology has been used across the world and more recently in developing countries to produce heat for tea processing, cooking, dairies, baking, and laundries. It has been observed to replace 30% of factories thermal energy requirements. This source would be cheaper, more reliable, more

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environmental friendly and would secure survival of the industry and by extension the livelihood of the farmers. The cheaper energy source would cut on factory costs which in-turn would result in higher payouts to the farmers. This would give the country a nudge in the accomplishment of Sustainable Development Goals (SDGs) 1 and 2 that emphasize minimization of poverty and supporting people-centred rural development. The initiative would also be a promotion of access to sustainable and modern energy, as well as leverage on the fight to combat climate change and its impacts as envisaged in SDGs 8 and 13.

According to literatures reviewed so far, there is no evidence of installed CSPT projects in Kenya. As per a report on a study conducted in Kenya in 2013 by Carbon Trust there were two dealers in small-scale concentrated solar energy systems by 2013 (one specializing in concentrated solar thermal systems, and another one specializing on concentrated PV) in Kenya. However there was no evidence of any installed CSPT systems for either industrial process heat generation or lighting. (Rawlins & Ashcroft, 2013). The sole dealer of thermal CSPT systems was reported not to have been aware of any installed CSPT system in Kenya and claimed efforts to gain acceptance of CSPT for industrial applications, had not been successful.

Even though solar heat technologies have exhibited a strong technical potential, and high promise for economic benefits for industry processes, their adoption has been very low (IEA-ETSAP & IRENA, 2015). To achieve higher market penetration of solar technologies, some new initiatives have been recommended. One of these initiatives is providing financing especially for covering the initial acquisition costs, and supporting use of solar heat energy technologies as an alternative to subsidizing use of fossil fuels by industries. Access to finance has been cited in many studies as a major determinant of technology adoption decisions (Silva, 2014; Topo, Moretta, Glorioso & Pansini, 2014; Hedeina, Pohlb, Mansorc & Genderen, 2015). Non availability of financial incentives, flexible funding mechanisms, high costs of capital and risks associated with new technologies have been highlighted as drawbacks to new technology adoption.

1.1 Problem statement

The tea factories run by KTDA in Kenya have a key role in the Kenyan Economy. They are a source of livelihood for about 700,000 families directly (farmers and workers) and indirectly benefit about 5,000,000 people. They also contribute about 4% of the country GDP and are one of the top foreign exchange earners. Beyond these, the factories are an important vehicle for rural development and generation of sustainable and equitable employment in line with sustainable development goals. However, in the last decade or so these factories have experienced a challenge that has threatened their business and by implication the contributions they make to the

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various stakeholders highlighted above. The challenge is in the form of high costs of heat energy for tea processing. The factories have been using fuel wood and fuel oil for this purpose. The factory managers have been complaining about the rising prices of these two sources of heat energy. Wood sources were also getting depleted and both sources have been found to be environmental pollutants and affect workers health. The factories have, therefore, been seeking for alternative sources of heat energy that are cheaper, environmentally friendly and are less hazardous to the staff. CSPT has been recommended for the factories but by 2013 none of the factories had installed the technology. This is a solar technology that has been embraced in many countries for heat generation which would replace 30% of the factories heat energy requirement. It would be cheaper, more environmental and staff friendly than wood and oil. One factor that has in several literatures reviewed been attributed to poor adoption of solar technologies is lack of financial resources. This study sought to find out the extent to which access to finance could influence the adoption of CSPT by tea factories run by KTDA in Kenya.

1.2 Objectives of the Study

To evaluate the effect of access to finance on the adoption of CSPT by the KTDA run tea factories in Kenya.

1.3 Research Hypotheses

This study was guided by the following null hypothesis.

$H_0$1: There is no significant relationship between access to finance and adoption of CSPT by the KTDA run tea factories in Kenya.

1. Theoretical Framework

This study was grounded on the Commercial Financial Instruments for Renewable Energy model. This model was authored by Dr Peter Lindlein and Dr. Wolfgang Mostert for the World Bank‘s Initiative, "Financing *Renewable Energies* in International Financial Cooperation” (Lindlein & Mostert, 2005). The authors of this model first outlined the demand profile for renewable projects financing. This demand is characterized by clients (investors, entrepreneurs and households) that have minimal experience and track-record; need for “patient capital” (both credit and equity); high external financing share; and very long term maturity period. Other characteristics were low Interest rate and limited capacity for security and collateral. For this profile the authors came up with benchmark commercial finance tools that would be used in identifying financing mechanisms in funding renewable energy projects. These tools are equity finance, debt financing, mezzanine finance and subordinated debt, and sales-lease-back arrangements.

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Equity funding may be in the form of capital injections from the owners or by third party capital gearing schemes such as venture capital funds and family members' contributions. This is important because lenders expect borrowers to take an equity stake in their projects to show their commitment and confidence in their project (Lindlein P. & Mostert W., 2005). Lenders will usually expect about 20% of the project cost to be raised by the borrower, and RET projects which are perceived to have higher risks may be expected to have a higher equity ratio requirement. Debt financing is to be in form of loans and other credit forms offered by commercial banks and other finance institutions. Bonds are another tool in this classification. They are borrowing instruments issued by companies to investors when they want to raise capital for various purposes. Sales-Lease-Back arrangements will involve financiers for RET equipment whereby the financier keeps ownership of the financed assets, thereby obviating the need for other collateral security.

The above cited model recommends access to finance mechanisms for renewable energy technologies, a category befitting CSPT. Nevertheless, mezzanine finance and subordinated debt initiatives are foreign in the Kenyan financial landscape and were therefore not investigated in this study. Access to finance elements investigated in this study were capital reserves, access to credit, cost of credit, collateral, grants from government, grants from development partners, subsidies, tax credits, venture capital, public private partnerships, and insurance schemes.

2. Empirical Review

Access to finance has been cited in several technology adoption literatures as a major barrier and requirement for energy technologies adoption schemes. In this section an analysis of past financial schemes is done, bringing out key parameters of the concept of access to finance. To begin with is a study report from the Mediterranean Countries titled Financial Support Mechanisms for Distributed Solar Technologies and Energy Efficiency Deployment in Mediterranean Countries. This study was conducted in October 2014 by Mediterranean Development of Support Schemes for Solar Initiatives and Renewable Energies (MEDDESIRE) in November 2014 (Topo, Moretta, Glorioso & Pansini, 2014). The objective of the study was to identify the financial support mechanisms that stimulate the diffusion of solar technologies in the Mediterranean countries. The study identified three ways to stimulate renewable energy investments. The first one was reducing cost of the investment through fiscal incentives or direct subsidies, providing incentives for the private sector to produce energy through renewable energy. These would include quota based support mechanisms, tender systems, net metering, feed-in tariffs and tax credits. The second mechanism recommended was increasing cash-flow through schemes like public private partnership, credit lines, project loan facilities, private equity funds, venture capital funds and project development grants. The last one was reducing the risk associated with the project through soft loans, guarantees and contract guarantees. These

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initiatives were recommended for enhancement of adoption of new technologies. However, the study did not give any reports of results of implemented schemes.

In the UNDP 'Energy Conservation in Small Tea Processing Units in South India' project, a key objective was to remove financial barriers that hinder adoption of renewable energy technologies. As an intervention, commercial lending for investment in RE technologies was implemented. A risk insurance scheme was also developed and implemented. Nevertheless, during the project, the project team realized access to finance was not a key barrier in investment in RE technologies (Ocampo & Maithel, 2012). Awareness of the technologies and capacity to adopt were found to be more profound interventions. In another project in India promoting solar concentrators for process heat applications in India, component 4 involved encompassing a sustainable financing mechanism for adoption of CSH technologies (Akker & Aggarwal, 2015). This in-turn involved promotion of understanding of financial viability of CSH projects, and initiation of favourable financial policies to encourage increased use of CSH technologies. Expected outputs were documented financial viability cases of CSH investments and banks/financial institutions identified to lend investors in CSH technologies at priority lending rates (as low as 5%) (UNDP, 2015; Akker & Aggarwal, 2015). By the third year of the project there was not a single documented case of CSH technologies financial viability. Though 15 banks/financial institutions had been identified for lending, no project had been developed using this benefit.

In Ghana access to credit was found to influence adoption of technology. This conclusion was made in a study that sought to find out the effect of lack of credit on the adoption of Cocoa Research Institute of Ghana (CRIG) recommended cocoa technologies (Obuobisa, 2015). The study involved 600 farmers and access to credit was found to have a significant influence on the technology adoption.

In South Africa a stakeholder's workshop was held in 2009 on a planned large-scale roll out of CSP technologies (Edkins, Winkler, & Marquard, 2009). The workshop identified the key drivers that would ensure the large scale roll out of CSP technologies. Lack of financial support was raised as a major drawback to the adoption of CSPs and financing mechanisms were suggested. These mechanisms included venture capital, grants from international development organizations, credit, equity, mezzanine debt and insurance covers. However, the researcher has not been able to trace the results of these mechanisms implementation.

From the above discussions it is apparent that access to finance is considered an important factor in new technology adoption. At least it seems to be so in the needs analyses and pre-

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implementation stages. However, as the projects matured it has been noted the access to finance does not seem to have much significance.

3. METHODOLOGY

The study adopted a positivism philosophy which emphasizes working with observable social reality that end up in law-like generalizations (Saunders et al, 2009). This study was a cross-sectional survey serving descriptive and explanatory purposes. The survey was chosen as it enables the researcher to obtain data about practices, situations or views at one point in time through questionnaires or interviews, which can be examined to detect patterns of association (Bryman, 2012). The target population was the sixty six (66) tea factories in Kenya managed by KTDA. The 66 tea factories were spread out in 13 counties in the country. The target respondents of this study were the sixty six (66) unit managers of the tea factories run by KTDA.

The population size was considerably small and this suggested that a census was feasible and therefore no sampling was done. Census is an investigation of all the individual elements that make up a population (Zikmund et al, 2013). In this study, therefore, all the sixty six factories managed by KTDA were studied. Data collection for this study was by use of questionnaires. Drop and Pick technique was applied with the target population. Data was analysed using descriptive statistics and inferential statistics obtained through logistic regression procedures. Firth penalized logistic regression model was selected for this study. The model offers solution to the problem of separation in logistic regression and small sample biases (Rahman & Sultsna, 2017; Eyduran 2008).

For inference purpose CSPT adoption was modelled against access to finance. Subset variables for access to finance were capital reserves, access to credit, cost of credit, availability of collateral, government grants, development partners grants, subsidies, tax credits, venture capital, public private partnerships, and insurance schemes. Model developed for access to finance was as follows:

$$\text{Logistf (CSPT Adoption)} = \beta + \beta 4X4$$

$$= \beta + \beta 1\text{AcessC} + \beta 2\text{CostC} + \beta 3\text{CostCap} + \beta 4\text{Colat} + \beta 5\text{GrntG} + \beta 6\text{GrntD} + \beta 7\text{Subsd} + \beta 8\text{TaxC} + \beta 9\text{VentC} + \beta 10\text{Ppp} + \beta 11\text{Insur} \quad \text{(i)}$$

Where β = is constant level of adoption not influenced by the regressor, X4 = access to finance, $\beta 1 \ldots . \beta 10$ are regression parameters, while AcessC, CostC, CostCap, Colat, GrntG, GrntD, Subsd, TaxC, VentC, Ppp, and Insur are access to finance predictors capital reserves, access to credit, cost of credit, collateral, grants from government, grants from development partners, subsidies, tax credits, venture capital, public private partnerships, and insurance schemes respectively.

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5. RESULTS AND DISCUSSIONS

5.1 Adoption of CSPT by Tea Factories

As explained earlier in chapter two, adoption is a process involving five stages. These are knowledge, persuasion, decision, implementation and confirmation stages. The managers were asked to indicate at what stage their respective factories were in in the adoption process. Sixty of the factories (91%) strongly agreed that their factories had not made any move towards the adoption of CSPT process. They were not aware of any CSPT information in the industry. This was an acknowledgement that of over ninety percent of the factories had not started on the CSPT adoption process, a stage that is describe as Prior. The other six of the factory managers were aware of the CSPT technology, and actually three of them (4.5%) had made a decision to adopt the CSPT technology. However, they had not implemented the decision. They were still in the procurement logistics. The other three of the factories were aware of the technology, its benefits and possible challenges. They were still evaluating the option of adopting but had not made the decision. These results are illustrated in Table 1.

Table 1: Factories CSPT Adoption Stage

Factory Adoption Status	Percentages					Mean	Std. Dev.
	SD	D	DK	A	SA		
The factory management has made no effort in CSPT adoption process (Prior)	9	0	0	0	91	4.64	1.149
The factory management is in information search stage of CSPT adoption process	100	0	0	0	0	1.00	0
The factory management is in information evaluation stage of CSPT adoption process	95.5	0	0	0	4.5	1.18	0.833
The factory management has made a decision to adopt CSPT technology	95.5	0	0	0	4.5	1.18	0.833
The factory management has installed CSPT technology	0	0	0	0	0	0	
The factory management has installed CSPT technology and is now in post installation evaluation	0	0	0	0	0	0	
Average						**2.00**	**1.732**

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The above distribution of the tea factories in accordance with their CSPT adoption status was tested for normalcy. This was by testing for skewness and kurtosis of the data. Skewness is a measure of data asymmetry with the normal distribution having a skewness value of zero (Hippel, 2010). A data distribution with skewness value two times or more of the skewness standard error is considered asymmetric, and therefore not normal. Skewness value for the CSPT adoption by tea factories status data was calculated at 2.809, with a standard error of 0.295. This skewness value is almost ten times its standard error and therefore implies that the distribution of data on CSPT adoption status of the tea factories is not normally distributed. Kurtosis is a reference of the extent to which observations cluster around a central point. For a normal distribution kurtosis is scored at zero. Any significant departure from this score reflects a distribution that is not normal. The data on factory CSPT adoption status was scored at 6.9. This finding supports the skewness measure results for a conclusion that the factory CSPT adoption status data is not normally distributed. These findings are illustrated in Table 2.

Table 2: Factory CSPT Adoption Status Skewness and Kurtosis

	N	Mean	Std. Deviation	Skewness		Kurtosis	
		Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
CSPT Adoption	66	1.2727	.75540	2.809	.295	6.900	.582

The objective of this study sought to find out whether there is a relationship between access to finance and adoption of CSPT technology by tea factories managed by KTDA. Sub-variables in this analysis were adequate capital reserves, cost of credit, access to credit, collateral requirements, grants from government and development partners, subsidies, tax credits, venture capital, private public partnerships and insurance schemes. Results of the study on access to finance and adoption of CSPT is now presented starting with descriptive scenario and then the inference.

5.2 Descriptive Statistics on Access to Finance

The respondents expressed their views on preferred elements under access to finance that are likely to influence their factories adopt CSPT. The elements of access to finance were adequate capital reserves, cost of credit, access to credit, collateral requirements, grants from government and development partners, subsidies, tax credits, venture capital, private public partnerships and insurance schemes. The manager's responses are summarized in Table 3.

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Based on these results, the top three elements of access to finance that are likely to influence adoption of CSPT by the tea factories were having adequate capital reserves (with 24% strongly agree and 62% agree approvals), access to credit (with 13% strongly agree and 68% agree approvals) and availability of collateral securities (with 6% strongly agree and 55% agree approvals). These are followed by cost of capital, existence of venture capital funds, public private partnerships, and insurance schemes and. The average mean for the variable 'access to finance' was 3.12 with a standard deviation of 0.243. This means access to finance score as a possible influencer of adoption of CSPT by tea factories managed by KTDA can be as low as 2.877 (out of 5), and can be a maximum of 3.363.

Table 3: Managers Responses on Access to Finance Statistics

Access to Finance Methods	Percentage					Mean	Std. Dev
	SD	D	DK	A	SA		
Factory had/has adequate capital reserves for installation a CSPT facility.	0	8	6	62	24	4.03	0.706
Factory had/has adequate credit facilities available for installation of a CSPT facility.	0	14	5	68	13	3.82	0.840
The cost of credit facilities influence the factory to adopt CSPT.	0	36	3	55	6	3.30	1.037
Collateral requirements to guarantee credit for installation a CSPT facility influences factory to adopt CSPT.	0	33	6	55	6	3.33	1.053
Adequate grant facilities from government available for procurement and installation of a CSPT facility influences factory to adopt CSPT.	5	50	39	6	0	2.47	0.684
Adequate grant facilities from development partners available for procurement and installation of a CSPT facility influences factory to adopt CSPT.	6	44	39	11	0	2.55	0.788
Subsidies offered for installation of a CSPT facility influences factory to adopt CSPT.	6	44	45	5	0	2.48	0.685
Tax credits offered for installing a CSPT	6	41	47	6	0	2.53	0.706

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facility influences factory to adopt CSPT.							
Availability of venture capital funds for installation of a CSPT facility influences factory to adopt CSPT.	0	20	32	48	0	3.29	0.780
Availability of Public Private Partnerships for installation of a CSPT facility influences factory to adopt CSPT.	0	22	33	45	0	3.24	0.786
Availability of Insurance schemes on investments in CSPT facility influences factory to adopt CSPT.	0	14	36	50	0	3.29	0.699
Average						**3.12**	**0.243**

5.2.1 Discussion

In the UNDP/GEF project with south India factories, funding was 46% grant by GEF while the balance 54% was co-financed by the government of India, Tea factories and the private sector (Ocampo & Marthel, 2012). Grant was, therefore, a major contributor in financing. This is unlike the KTDA manager' preference case, in which only eleven percent (11%) of the managers felt there were adequate grant facilities (from government and development partners) to influence the adoption of CSPT. This, therefore implies lack of grants access for the factories. Government contribution, factory capital reserves and public private partnerships have a similarity in both scenarios. In a similar project by UNIDO, GEF and MNRE in India promoting business models in concentrated heat energy technologies a soft loan scheme was established as an incentive. It was collateral free, interest at between 5-7%, a grace period of 1 year and repayment period of seven years (Misra A. 2016).Then there is the UNDP 'Energy Conservation in Small Tea Processing Units in South India' project, in which to remove financial barriers hindering adoption of renewable energy technologies, a commercial lending for investment in RE technologies was implemented. An insurance scheme was also developed and implemented. In general there seems to be a good match of financial incentives that would lure tea factories in Kenya to adopt CSPT with those that have been used for the same purpose elsewhere.

5.3 Inferential Statistics of Access to Finance and Adoption of CSPT

The fourth objective of this study was to find out the likelihood of access to finance to influence the adoption of CSPT among tea factories managed by KTDA. To enable measurement of this objective using field data, a fourth study hypothesis was developed which stated that:

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$H_0$4: There is no significant relationship between access to finance and adoption of CSPT among the Kenyan tea factories run by KTDA.

The elements of access to finance were adequate capital reserves, cost of credit, access to credit, collateral requirements, grants from government and development partners, subsidies, tax credits, venture capital, private public partnerships and insurance schemes. These sub-variables and CSPT adoption were regressed using the Firth algorithm. Results of the firth logistic regression are detailed in table 4.

The model scored a McFadden R2 of 0.394. This falls within the perfect fit range of 0.2-0.4, and the model can be used to predict adoption of CSPT by tea factories managed by KTDA. However, the access to finance model was found to be statistically insignificant in influencing the likelihood of the adoption of CSPT by tea factories managed by KTDA, with a Chi2 p-value of 0.6253. This was beyond the 0.05 threshold. This implies that access to finance was not significant in influencing the likelihood of the adoption of CSPT by tea factories managed by KTDA at 95% confidence level. By implication it would, therefore, not be one of the prime initiatives targeted to influence the adoption of CSPT among tea factories by KTDA. This will in turn lead to the acceptance of the forth hypothesis of this study which stated that 'There is no significant relationship between access to finance and adoption of CSPT among the Kenyan tea factories run by KTDA'. Consequently the variable 'access to finance' will be expunged from this study's model expressed in equation (xi).

Out of the eleven elements of access to finance only three were found to be statistically significant. These were grants from government (with a p-value of0.03423), grants from development partners (with a p-value of 0.03125) and public private partnerships (with p-value of 0.04901). The others were found to be insignificant in their likelihood to influence the adoption of CSPT as they had p-values beyond 0.05.

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Table 4 Access to Finance & Likelihood to Enhance Adoption of CSPT

N=66 Model: Firth Logistic regression (logitf) N of 0's: 63 1's: 3 (Access to Finance)

Penalized log likelihood = -1.06594 Prob> chi^2 = 0.6253

McFadden R^2=0.3904

	Const.B_0	**Capital**	**Credit**	**Cost of C**	**Collateral**	**GrantG**	**GrantD**	**Subsidies**	**Tax**	**Venture**	**PPP**	**Insurance**
Estimate	-1.216653	0.94268	0.70171	0.054761	-1.200913	1.10249	1.217361	0.2004091	-0.17361	0.274923	0.515023	-1.60901
p-value		0.05468	0.30136	0.48827	0.83884	0.03423	0.03125	0.08407	0.05674	0.381158	0.04901	0.72959
Odds ratio		2.5668	2.0171	1.0562	0.03009	3.01165	3.3426	0.8183	0.8406	1.3164	1.6736	0.2000

The access to finance model earlier expressed in equation (vii) will now be modified to the representation in equation (xiii) below.

Logistf(CSPT Adoption) = -1.216653 + 1.102GrntG + 1.217GrntD + 0.515Ppp (ii)

Written in full as:

Logistf(CSPT Adoption) = -1.21665 + 1.102GovernmentGrants + 1.217DevelomentPartnersGrants + 0.515PublicPrivatePartnerships (iii)

Odd ratios calculated show grants with highest scores of over 3. However, availability of credit and cost of credit had higher odds than public private partnerships even though the two had been found to be statistically insignificant. This implies that when considered individually they may influence adoption of CSPT whenever they are varied by one unit. However when considered together with all the other covariates they are not likely to influence adoption of CSPT at 95% confidence level.

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5.3.1 Discussion

This finding has an interesting comparison with scenarios in projects mentioned earlier in adoption promotion efforts. All the project reports earlier from India and Malaysia had a component of enhancing access to finance especially through development partners' grants and attractive credit schemes (Misra A. 2016; Ocampo & Marthel, 2012; Akker & Aggarwal, 2015; Topo, Moretta, Glorioso & Pansini, 2014; UNDP, 2015). Actually the UNDP and UNIDO projects in India to promote adoption of CSTs started with grants from GEF. This highly corresponds with the expectations of the tea factory managers in Kenya, meaning if finance was to be considered in efforts to spur adoption of CSPT, then identification organizations like UNDP and UNIDO would be required to bankroll the initiative. Further, just like in this study, access to finance was not found to be a key determinant in making the adoption decision. In the UNDP 'Energy Conservation in Small Tea Processing Units in South India' project, during implementation, project team realized access to finance was not a key barrier in investment in RE technologies (Ocampo & Marthel, 2012). The team had to adjust focus to other variables like awareness and technical capacity. In the other project 'Market Development and Promotion of Solar Concentrators for Process Heat Applications in India Project' in India, though friendly credit schemes were put in place, by the third year of implementation not a single investor had taken these benefit in their CST projects (UNDP, 2015. To a big extent, therefore, this study's finding access to finance not a key initiative in the greater effort to promote adoption of CSPT among tea factories in Kenya is supported by these past relevant cases.

These findings contradict the Commercial Financial Instruments for Renewable Energy model that this study was based on, and the assumption and expectations of policy makers on the importance access to finance. Access to financial resources is mostly considered a key initiative for any project, but empirical literature and findings of this study have largely shown that in solar energy technologies adoption projects this is not so. In these projects there is a contradiction of the presumed importance of access to finance in adoption of new technology, which is apparently a paradox.

6. Conclusion

Most of the managers indicated that the factories have adequate capital reserves, access to credit, and have collateral security that might be required for CSPT installation. Meaning lack of finance in form of organization reserves and access to credit were not a contributor to non-adoption of CSPT. Yet they had not adopted this technology. It can therefore be concluded that access to financial resources was not among the more likely factors to have hindered adoption of CSPT. However, some of the elements under access to finance were reported to be likely to influence adoption of CSPT. These were grants (from government and development partners) and joint ventures. The grants were also found to be a frequent tool in initiating CSPT projects especially in India spearheaded by UNDP, UNIDO and GEF.

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