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CASE STUDY

Evaluating the Status of Technologies Transferred to Users: Evidence at the University of Gondar, Ethiopia

University of Gondar, Ethiopia

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Abstract

Increasing demands but lack of adoption for technologies are the key challenges of technology transfer. The level of utilization with improved technologies and advanced systems are limited. The objective of this paper was to examine the status of transferred technologies and to evaluate determinants that influenced the functioning of transferred technologies. This study is conducted at University of Gondar, Ethiopia. All 135 investigators who granted technology transfer projects between 2012 and 2021 were taken for the study. Participant observation, questionnaire, document review and focused group discussion were used for data collection. Descriptive statistics, qualitative narrations, and Binary Logit econometric model were employed for data analysis. The study results revealed that 11% of principal investigators were females. About 87.4% and 12.6% investigators were 2nd and 3rd degree holders, respectively. The proportion of soft and hard system granted projects were 44.4% and 55.6%. About 34.1% and 29.6% of the technologies were transferred and utilized to end users. About 13.0% of the adopted technologies have possibility of making business or startups and some of them can be used for manufacturing industries. The model results indicated that college types, year of granting, type of technologies and transfer, implementation and technology users are positively influenced the functioning of technologies while age of college and field distance negatively affected the utilization of technologies. Therefore, adequate time and budget, and data-base management systems are suggested for effective functioning and sustainability of transferred technologies.

Keywords: Innovation, linkage, system, technologies

Introduction

Ethiopia is predominately relying on rain-fed agriculture and subsistence farming. Agricultural mechanization was started during the Imperial era and advanced to state farms during *Derg* regime after 'land to the tiller' was proclaimed in 1975 (Dereje, 2019). Since then, improved technologies have been introduced to the agricultural sector. Recently, technology generation and transfer is mandated to Universities with a broader approach (Marina, 2008) as teaching, research, and community engagements are the key pillars of higher teaching-learning institutions. Some research outputs either transferred to community services or adopted to technologies. Hence, technology transfer is one of the focus areas of Universities that contributed to the national development and economic growth (Gokmen and Turen, 2013).

According to systems dynamics theory, the combination of theory, methods and philosophy is essential to how things change over time (Hamilton, 2020). The theoretical framework of the resource-based view and resource dependency theory enables to integrate of human, physical and organizational processes. On the basis of this theory, research Universities like UoG need to reach systems for potential technologies, innovations and mechanisms for funding, commercialization and linkage with industries.

3. Materials and Methods

Study descriptions

The study is delimited to UoG where different technologies and innovations have been developed and disseminated to end users. Innovators and technology adopters are principal and co-investigators. According to the UoG guideline, the Principal Investigator (PI) is an academic staff of the UoG or any funding organization to direct the project or program supported by the fund. Whereas, Co-Investigator (Co-PI) is an academic staff or an expert and a member of a project with defined roles and responsibilities. Based on the nature of the project, either a technology can be deployed and used in the university or might be disseminated to intended end users for the surrounding communities. Essentially, the adopted or innovated technologies are disseminated either in terms of business or for free. Investigators have used different dissemination mechanisms for their knowledge and technologies such as physical apparatus, print media, and social media like television, radio and others. Articles, text books, books, teaching materials, modules, manuals, flyers, posters, leaflets, policy briefs, conference booklets, and trainings are also knowledge and technology dissemination tools.

Sampling, methods of data collection and analysis

***Data, sampling and methods of data collection*:** This study is conducted in UoG where several technologies and innovations are developed and transferred. Both qualitative and quantitative data types were collected from primary and secondary sources. A direct census was conducted by taking lists of investigators who granted technology transfer projects between 2012 and 2021. A total of 135 investigators were taken for the study. The data were collected between July and August 2023. The methods of data collection include participant observation, document review, questionnaire and one focused group discussion with 10 members. The group discussants were technology transfer coordinators.

***Data analysis*:** Descriptive statistics, inferential tests (T-test and Chi-square), econometric model and narrative methods were used for data analysis. The Binary Logit model was used to compute the dependent variable with independent variables using SPSS version 20. This model is preferred because it gives standard results for dichotomous choice estimation (Greene, 2007).

$$Logit(P_i) = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_n X_{ni} + e_i \quad (1)$$

Where: $P(_i)$ is the probability that i^{th} value of the dependent variable, X is the i^{th} value of the independent variables, e_i is the error term that the dependent variable is not explained by the independent variables, and n is the number of independent variables.

$Odds = \frac{P_i}{1-P}$, the probability of an event that will happen, that is, technology functioning divided by the probability of the event will not happen (the technology not functioning). Thus, the Logit (Natural log of odds) of the unknown binomial probabilities is modeled as a linear function of the X_i. the probability of an event that will happen, that is, $Logit(P_i) = Ln(\frac{P_i}{1-P_i}) = \beta_0 + \sum_{j=1}^{n} \beta_j X_{ji}$

The model assumes that the underlying stimulus index Logit(P_i) is a random variable, which predicts the probability of technology functioning. P_i is the probability of technology functioning, while (1-P_i) is the probability of a technology that was not functioning. Dependent and independent variables were taken for the study. The hypothesized dependent variable is technology functioning while independent variables are shown in Table 1.

Table 1: Hypothesis of independent variables descriptions and measurements of the status of technology

Acronym	Descriptions	Type	Measurements	Hypothesis
SEX	Sex of PI	Dummy	1=male, 0 otherwise	+ (male)
EDU	Educational level of PI	Continuous	Educational status	+
COLLG	Name of colleges	Discrete	1 to 11	+ (early)
YEAR	College established	Continuous	Years	-
GRANTYR	Project grant period	Continuous	Years	+
TTYPE	Technology type	Dummy	1 = system, 2 = hardware	+ (hardware)
IMPL	Is technology implemented?	Dummy	1 = yes; 0 = otherwise	+
TRANSF	Is technology transferred	Dummy	1 = yes; 0 = otherwise	+
PICHANG	Was there PI Change	Dummy	1 = yes; 0 = otherwise	-
USER	Users	Dummy	1 = yes; 0 = otherwise	-
COTURN	Coordinators turnover	Continuous	Number of turnovers	-
ASTAF	Academic staff size	Continuous	Number	+
DIST	Distance between UoG and technology users	Continuous	Km	-

Dependent variable: It is the status of technology whether functioning or not. It is a dummy variable with a value of 1 if the technology is functioning or utilizing the end-user or zero otherwise

Dependent variable**:** It is the status of technology whether functioning or not. It is a dummy variable with a value of 1 if the technology is functioning or utilizing the end-user or zero otherwise.

Independent variables**:** The year of the principal investigator's experience, level of education for the investigator, communication or coordination and staffing are independent variables used in the study of Hamilton (2020). The variables for years of foundation, technology policy, resources, reward and networking are found in the study of Gallego *et al.* (2009). These variables may influence the adoption of technologies. Sex and distance are potential explanatory variables in most technology adoption studies. The remaining independent variables are operationally and contextually adopted by focused group discussion. A multicollinearity test was employed for continuous variables for its intercorrelation using Variance Inflation Factor (VIF), and the values of VIF are less than 10. Similarly, a Contingency Coefficient was used to test discrete variables. There was no strong association between dummy independent variables and its dependent variables and its value was less than 0.75 as stated by Greene (2008). Hence, in both cases, there were no multicollinearity problems.

3. Results and Discussion

Overview of technology transfer projects and the major attributes of investigators

In the UoG, technology transfer projects were not granted for a decade (Haimanot et al., 2014). The technology transfer office was established in 2012 and since then technology transfer projects have been granted and implemented. Despite female academicians having participated in technology transfer projects, their participation in terms of number was limited and the proportion of female investigators was 11.0%. The majority (89.0%) of investigators were males as the ratio of female academic staff was lower than their male counterparts in the UoG. Nevertheless, females have participated in scientific decision-making processes and engagements in academic expertise. The educational level investigators were Master's and PhD holders. Nearly, 87.4% of investigators were masters of sciences or arts while the remaining 12.6% were PhD holders.

Table 2: Correlations and associations among independent variables

Variables	Adopted (N = 40) Mean	Non-adopted (N = 95) Mean	T/X^2 values	P-values
Age of college, years	2006.68 (13.76)	2002.53 (16.57)	-1.408	0.161
Grant period, years	2018.23 (1.97)	2017.53 (2.04)	-1.839	0.068
Coordinator turnover, number	1.68 (1.12)	1.64 (1.64)	-0.116	0.908
Academic staff, number	136.18 (84.27)	266.55 (307.89)	2.493	0.014
Distance, km	24.58 (35.38)	29.59 (47.68)	0.599	0.550
Educational level	2.15 (0.36)	2.12(0.32)	-0.544	0.588
Sex of investigators †			0.135	0.039
College where investigators belongs †			0.373	0.005
Technology types †			0.216	0.010
Technology implementation †			0.348	0.000
Technology transfer †			0.441	0.000
PI change †			0.045	0.598
Technology users †			0.014	0.875

Note: *, **, *** indicated for 10,5, and 1% significant level; denoted to discrete variables; figures in brackets are standard deviations

The T-test was employed to show the correlation of continuous independent variables while the Chi-square was employed to reveal the association of discrete variables (Table 2). The T-test showed that recently granted technologies were functional compared to previously granted technologies. The size of academic staff was positively correlated with technology functioning. The Chi-square test revealed that the sex of investigators, college types, type of technology, implementation and transfer had significant associations with the functioning of technologies. Functional technologies were disseminated relatively at near distances. The minimum and maximum distance of technology transfer, were 0.5 and 177 km, respectively.

Technology transfer

The center, institute, college and University statuses were established between 1954 and 2016. During the study period, the number of colleges, institutes and school were 8, 2 and 1, respectively. Medicine and Health Sciences is the first established college in UoG while the latest is institute of biotechnology. Academic staff in the college of education and institute of biotechnology were not participated in technology transfer projects as PIs. Almost one-fifth of the total investigators were from institute of technology followed by college of informatics and vet medicine and animal sciences. The trend of granted projects are shown in Fig. 1.

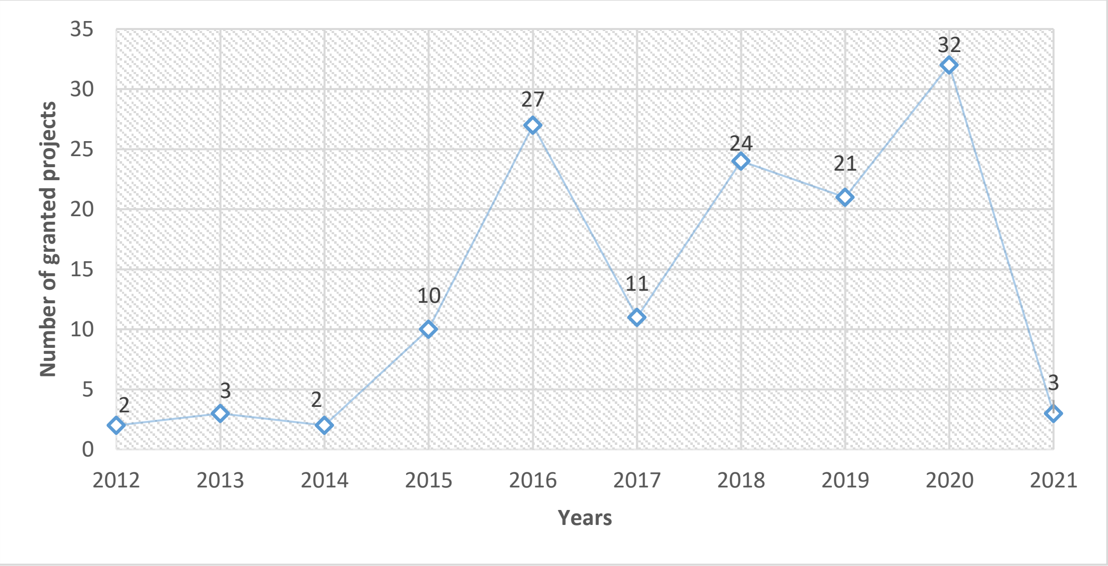

Figure 1: Granted projects (2012-2021)

Soil: Soil fertility enhancement and organic waste management activities were practiced in different farming communities. Organic fertilizer, and soil and water conservation technologies are implemented in *Gondar Zuria* District with the support of the UoG. Among organic fertilizers, vermicomposting was prepared and used to enhance the fertility status of soils for which the *Teff (Eragrostis tef (Zucc.) Trotter*) crop was grown. *Asenia fotidea* is among worm species adapted to poultry feeds transferred to users in Gondar City and Gondar Zuria District. Soil fertility amelioration measures compost, terraces, farmyard manure and tree planting were implemented and adopted after training and awareness creation (Kassaye and Abay, 2019).

Herbs: Since 2016, the School of Pharmacy of the referral hospital of UoG, has compounded different herbs for the treatment of patients. In a study conducted by Abebe et al (2018), 62% of households are herbal medicine users. In *Dembia* District of the Central Gondar Zone, more than 24 plants were identified for malaria treatments (Abyot, 2013).

***Knowledge**:* Different trainings were delivered to high-tech knowledge demanding skills such as software application and 3D printing machines to polytechnic instructors and university teachers. Digitizing of church manuscripts and creation of electronic archives are among the knowledge-based technologies developed in the UoG. Nearly 39.0% of the students, in the Universities never used electronic communication devices in the beginning of 2010s (Solomon et al., 2013). Currently, more than 75.0% of students access at least a mobile phone for their communication. High school and university students use mobile phones and the internet to work out educational-related assignments and knowledge development.

Irrigation: Water use efficiency can be applied using different schemes such as drips, pumps and river diversion for market-oriented crops. Wastewater treatment system and water storage tankers were designed and fabricated. In Ethiopia, improved water harvesting technologies including hand-dug wells, trapezoidal, doom, hemispherical, and bottle neck-shape structures; drip systems, and different water pumps were introduced to Ethiopia in 2002

(Wuletaw, 2011). However, most of the water harvesting structures were not successful and were not used for intended purposes (Giordano et al., 2012). It is only 15.6% of households adopted irrigation technologies in North Shewa, Ethiopia (Solomon et al., 2021). In contrast, farm households have a high demand for water for irrigation and nearly 98.0% of sampled households are willing to pay for sustainable irrigation water supply (Agerie et al., 2022.

Post Harvest Technology: The estimated post-harvest loss for cereal crops in Ethiopia is 30-50% (Dubale, 2018). Hence, post-harvest technologies are essential to minimize such types of losses. Investigators of UoG constructed post-harvest technologies for potato storage and cooling chambers for tomatoes at *Teda* campus and *Woreta* town, respectively. An indigenous knowledge technology was also adopted for maize stock borer protection. Recently, the UoG introduced tractors and combined harvesters to improve pre-and post-harvest loss of crops. A team of experts developed a multi-purpose agricultural machine at the University. However, the machine was not completed so that did not transfer to end users.

Crops*:* Improved crop varieties are disseminated to users. Improved maize variety, locally selected food barley, improved malt-barley and improved *tef* crop varieties are promoted to rural households in *Dabat*, *Wogera*, and Central Gondar districts. Hybrid vegetable varieties such as watermelon (*Polimore* and *Lahat* F_1), red onion (*Sivan* F_1 and *Red Coatch*), and tomatoes (*Galilea* and *Shanty*) were popularized and demonstrated to forty farmers at west Gondar, *Dembia* and for about 150 University staff at farm center around *Shinta* river near to *Tewodros* campus of UoG. Mushroom was introduced and transferred to youth groups in Gondar city. Nevertheless, it was not sustainably adapted and adopted. Agricultural technologies mainly chemicals (fertilizers, pesticides and herbicides), improved seed varieties, and animal breeds are copied into technologies. University researchers adopted these technologies to enhance crop and livestock systems. Several researchers have released numerous improved crop varieties in the country as well so that the trends of yield increment are improving (Getachew and Tigabu, 2019).

Energy*:* Investigators adopted prototypes of solar systems for different purposes. Solar photovoltaic–based electrification was introduced to *Denkez* public school and the surrounding village in Gondar *Zuria* district. controllers, biogas, and wind-powered water lifting systems are among adopted energy related technologies. Wind turbine is also one of the disrupting energy sources. A study conducted in West Shewa, Ethiopia revealed that 41.4% of the rural households used modern technologies like solar renewable energy (Seble and Amenu, 2021). In Ethiopia, the major sources of energy include hydro-power, solar, wind, geothermal, wood, agricultural waste and biogas (Ashebir and Desta, 2020).

Devices: Despite machines being devices, the latter are simple equipment and materials fabricated for different purposes. Investigators adopted cross bicycles, health riders, door openers, splitters, mechanical ventilators, sample collection booths, disinfectants, masks, IV-stand, hand and pedal-operated washers, and dispensers. Innovators fabricated different devices in different countries like projectors, computers, magnetic whiteboards, audio-visual centers, digital libraries, smart boards, iPads, video conference systems, desktops, laptops and many others which can enhance the quality of education (Nwabuez *et al*., 2019). Technologies help with research, teaching, communication, Facebook, entertainment, discussions, and learning management systems. The majority of technology devices are fabricated from abroad and improved through business companies in Ethiopia.

Machines*:* Various machines were designed and fabricated by university investigators. Some of the machines implemented in the University include juice extraction, metal bending, species grinder, butter churner, dental care, onion peeling, sand sieving, animal feed chopper, *teff* row planter, bone crusher and multipurpose agricultural machines. Among the listed machines, the feed chopper is fabricated and transferred to farm households and it has been used for livestock feed chopping.

Similarly, high school students trained at Science, Technology Engineering and Mathematics (STEM) in UoG were participated in national innovation competitions by Robotics and other prototype innovations in 2020 and 2021. Nowadays, elementary, high school and university students are aware of innovations and technologies. In UoG, innovators adopted drones, 3D products, and renewable energy sources like wind energy machines. These are disruptive technologies (Valavanidis, 2020).

Mobile Applications: It refers to different mobile applications implemented for various purposes using smartphones. Mobile apps are adopted for city guides, tourist counting and tracking, enabling to formulation of animal feedstuff, access information on life skills and code of conduct for university students and teachers and to classify some human diseases. A technology adopted for mobile apps can send short messages to customers like blood donors. It also manages information, for example, team training programmes, and health care systems such as mental and diabetics. Mobile applications have benefits on multimedia, productivity, travel and utility for communication. Rules of the game are accessed through mobile apps that have wide applications for social net, weather news, sports, banking, maps, movies, retail, search, and photos and videos. According to the study of Islam *et al* (2010), games, weather maps, and social networking are the most prevalent uses of mobile apps at the global level.

Animals*:* Technologies related to animals were implemented to improve livestock production and productivity. The adopted technologies include poultry hatchery, bee transporter, feed treatment, fish management, artificial insemination, and synchronization for dairy cows, dog handling tools, hen brooder box, equine welfare, animal restraining techniques, animal feed improvement, sericulture and aquaponics. Manure removal, milking and cooling are also essential technologies adopted for animal production (Yolanda e*t al.*, 2015). Artificial insemination and improved feed mainly for dairy cows are demand-driven technologies (Okello et al., 2021). A team of investigators in the College of Veterinary Medicine and Animal Sciences disseminated dog-restraining technologies with full packages. Dog muzzle masks, dog-catching nets, and dog restraining crushes are designed, implemented and transferred to end users to vaccinate and eradicate mass canine rabies (Anmaw *et al.*, 2022).

***Websites*:** These technologies are implemented to serve customers such as students, tourists, teachers, and stakeholders. Similarly, some websites were developed to manage data and information on projects, publications, journals, laboratory materials, university apartments, health insurance systems, budgets, disease surveillance, and more related activities. The UoG has server space for different websites and webpages including student enrolment and placement, grade recording, project management, and others. Websites enable improved services and the possibility of communication with several organizations, institutions and individual customers (Gallego *et al.*, 2009). Websites can disrupt the conventional and manual services of organizational systems.

The author has personal observations related to technology granting, implementation, transfer and monitoring and evaluation phases of granted projects. A focused group discussion was also employed mainly for two reasons. To contextualize explanatory variables and select potential innovations and technologies for commercialization. Various technologies were designed, adopted and adapted by University researchers. Among granted and transferred technologies, discussants have selected potential technologies for business startups. These technologies include the manufacturing of machines, web-based digital systems, innovations, and technologies related to indigenous knowledge. Manufacturing technologies include paper recycling, plastic rope and broom making from waste plastic bottles, water storage tanker, honey bee colony transporter, wheelchair for disabled persons, sand sieving, feed chopper and grinder, organic fertilizer maker and maize Sheller machines. Project information management, student information management and student placement are web-based systems. Recovery of power storage capacity of laptop computer batteries is patented innovative technologies. Pharmacy compounding, honey wine production, and organic fertilizer production like vermicompost and water hygiene are indigenous-related technologies. Three-D printing such as different letters, symbols, numbers, devices, and other technology inputs are identified for business startups. It is, therefore, about 13.0% of the granted technologies are possibly selected for business startups.

Determinants of technology transfer

The Binary Logit model was applied for analysis. The Omnibus test of goodness of fit in Chi-square indicated that the null hypothesis has determined that the step was justified. When the step is to add a variable (s), the inclusion is justified if the significance of the step is less than 0.05. Had the step been to drop variable(s) from the equation, the exclusion would have been justified if the significance of the change was more than 0.10. Therefore, the likelihood ratio of Chi-square of 80.09 with a p-value of 0.000 shows that the outcome model as a whole fitted significantly. The overall model was significant and a good fit.

Thirteen variables were entered into the model. The college types, years of college establishment and granting period, type of technology, implementation, technology transfer and access to users were significant variables. The scope of the study in terms of area coverage addressed the surrounding up to 77 km away from the university. The study technologies included years between 2012 and 2021.

***College types*:** The model results were statistically significant at 1% (P=0.008) showing a positive relationship with the functioning of transferred technologies. The reference college is the College of Medicine and Health Sciences. Projects granted at Central, College of Informatics, College of Agriculture and Environmental Sciences, and Institute of

Technology were functioning well compared to projects granted to the College of Medicine and

Table 3: Model results

Variables	β	S.E.	Wald	Sig.	$Exp(\beta)$
Sex	-1.706	1.408	1.468	0.226	0.182
Education	0.002	0.887	0.000	0.998	1.002
College types	1.740***	0.659	6.960	0.008	5.696
College establishment period	-0.246***	0.091	7.319	0.007	0.782
Grant year	0.472***	0.166	8.061	0.005	1.603
Technology type	2.025**	0.929	4.747	0.029	7.575
Implementation	18.837***	6017.765	0.000	0.998	$151*10^6$
Technology transfer	2.668***	0.819	10.619	0.001	14.418
PI change	1.275	1.058	1.452	0.228	3.580
Tech users	0.104**	0.860	0.014	0.904	1.109
Coordinator turnover	-1.401	0.773	3.284	0.070	0.246
Academic staff size	0.002	0.003	0.336	0.562	1.002
Distance	-0.016*	0.009	2.991	0.084	0.984
Constant	-490.602	6028.275	0.007	0.935	0.000

Health Sciences, Business and Economics, Social Sciences and Humanities, and Natural and Computational Sciences with odds ratio of 5.696. The nature of the management level being central or college level as recently established, fixing other independent variables constant, the likelihood of technology functioning increases by nearly sevenfold. Other findings support this result. The technology-organization-environment nexus is extensively used for technology adoption (Dube et al., 2020). Technology adoption is directly correlated with the performance of the working unit or company performance (Mustafa and Taakub, 2018).

Age of college: It is statistically significant at 1% (P = 0.007) showing a negative relationship between age of college establishment and functioning of technologies at a coefficient value of -0.246. The odds ratio of 0.782 indicates the years of college establishment implying that earlier established colleges had a low chance of technologies to be functional, which declined by sevenfold while fixing the value of other independent variables.

Years of granting: It is statistically significant at 1% ($P = 0.005$) showing a positive relationship between the year of a project grant and the functioning of technologies. It implies, that as a granting period increases by a year, holding other independent variables constant, the likelihood of functioning technologies increases by an odds ratio of 1.603. The probable reason for this finding might be the function of several reasons. The cost of materials for technology fabrication was relatively low in previous years compared to the current material prices. Moreover, technology adoption needs more time for its acceptance and proper functioning.

Type of technology: The model result showed that the type of technology was statistically and positively significant at 1% (P=0.029). As technologies are hardware like machines, devices, breeds, seed varieties, and similar technologies, the chance of technology functioning increases by the odds ratio of 7.575. For the type of technology, fixing other independent variables constant, the likelihood of technology functioning increases by four times compared to soft system-related technologies.

Technology transfer: As expected, the probability of technology functioning of disseminated technology increases, under citrus paribus, with technology transferred to end users. As technology is transferred, the chance of functionality increases with an odds ratio of 14.418. Hence, the relationship between technology transfer and technology functioning was positive and significant at 1% (P=0.001).

Turnover of coordinators: In this study, coordinators refer to university-industry linkage and technology transfer coordinators of a given college or institute. Coordinators facilitate the overall activities of technologies and industry linkages. This variable is correlated with technology functioning negatively and significantly at 10% (P=0.070). As the turnover of coordinators increases by one, the likelihood of functioning technologies declines by the odds ratio of 0.246. Hence, personnel turnover had negative impacts on the management of technologies (Karna et al., 2020).

***Distance**:* This variable has a negative and significant correlation with technology functioning at 10% (P=0.084). As the distance from the University to the end user increases by one km, the chance of functioning of technologies declines with an odds ratio of 0.984.

5. Conclusion

Implementation and management of projects of the UoG have long procedures. Call for papers, proposal development, proposal submission, proposal evaluation, proposal approval, ethical clearance, budget allocation, granting, project agreement, financing, implementation, reporting, monitoring and evaluation are among the key procedures of project management. As the technology is tested or completed, it can be transferred or disseminated to end users based on approved project proposals. In the meantime, other unintended circumstances, such as grievances, complaints, project termination, principal investigator changes, and others might need to be managed accordingly. These all are documented in the recently approved UIL and TT guidelines of UoG.

Technology transfer is one of the sub-pillars of university mandates. UoG was established 68 years and runs 303 academic programs organized in five campuses. Despite the UoG has numerous achievements, the organization went through several challenges and bottlenecks. The status of technology adoption and adaptation is still at the infant stage. Despite the UoG is established in 1954, technology transfer was carried out for the past ten consecutive years until this data collection took place. During this period, 135 projects were granted, of which 34% and 30% were transferred to end users and well-functioning, respectively.

A variety of technologies are adopted both in the soft and hard system of a total granted technologies nearly 13.0% can be linked to businesses or commercialization and startups. Centrally funded projects and projects granted to recently established colleges were better functioning compared to college-level granted and older colleges. On the other hand, recently granted technologies were not functioning as previously transferred technologies. It implies that time is a key factor for technology adoption. Technology transfer is directly and significantly correlated with technology adoption. Therefore, emphasis should be given to college management and its excellence, adequate time of implementation, and transfer to end users is very crucial for the proper functioning and successful adoption of technologies. Turnover of coordinators and long-distance adversely affected the functioning of disseminated technologies. Hence, either the frequency of turnover for coordinators and distance has to be minimized or a proper handover system and database management has to be established.

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Declarations

Conflict of Interest: The author declared there is no conflict of interest.

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