Ontario Library

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The purpose of the analysis is to:

1. Assess how effectively each library is managing revenue generation and cost control at cardholder level.
2. Measure the ability of libraries to secure funding, manage resources efficiently, and make strategic investments in services and facilities for their long-term sustainability.

Load library packages

```
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
library(ggplot2)
library(knitr)
library(magrittr)
library(tidyverse)
```

```
## ── Attaching core tidyverse packages ──────────────────────── tidyverse 2.0.0 ──
## ✓ forcats   1.0.0     ✓ stringr   1.5.0
## ✓ lubridate 1.9.2     ✓ tibble    3.2.1
## ✓ purrr     1.0.2     ✓ tidyr     1.3.0
## ✓ readr     2.1.4
```

```
## ── Conflicts ────────────────────────────────────────── tidyverse_conflicts() ──
## ✖ tidyr::extract()   masks magrittr::extract()
## ✖ dplyr::filter()    masks stats::filter()
## ✖ dplyr::lag()       masks stats::lag()
## ✖ purrr::set_names() masks magrittr::set_names()
## ℹ Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors
```

```
library(tidyr)
library(knitr)
```

Load all dataset

```
setwd("C:/Users/titil/OneDrive/Documents/UPLIFT/Module 2/Assignment 2")

lib_6<-read.csv("lib_2006.csv")
lib_7<-read.csv("lib_2007.csv")
lib_8<-read.csv("lib_2008.csv")
lib_9<-read.csv("lib_2009.csv")
lib_10<-read.csv("lib_2010.csv")
```

Select column headers of interest

```
headers<-c("Library", "Year", "City", "Library.Service.Type", "X..of.Active.Library.Cardholders",
"Total.Operating.Revenues", "Total.Operating.Expenditures")

lib6 <-lib_6[headers]
lib7 <-lib_7[headers]
lib8 <-lib_8[headers]
lib9 <-lib_9[headers]
lib10 <-lib_10[headers]
```

Bind all dataset with new headers from year 2006-2010

```
libs_all<-rbind(lib6, lib7, lib8, lib9, lib10)
knitr::kable(head(libs_all, 5))
```

Library	Year	City	Library.Service.Type	X..of.Active.Library.Cardholders	Total.Operating.Revenues	Total.Operating.Expenditures
Addington Highlands Twp	2006	Flinton	Public or Union Library	715	81375	81556
Adjala-TosorontioTwp	2006	Alliston	Contracting Municipality	0	41305	41305
Admaston - Bromley Public Library	2006	Douglas	Public or Union Library	480	26113	17432
Ajax	2006	Ajax	Public or Union Library	55146	2889854	2918300
Alderville FN	2006	Roseneath	First Nations Library	126	36751	36751

Create a new metric for revenue per cardholder

```
rev_exp_cardholders <- libs_all %>%
  mutate(
    rev.cardholders = `Total.Operating.Revenues` / `X..of.Active.Library.Cardholders`,
    exp.cardholders = `Total.Operating.Expenditures` / `X..of.Active.Library.Cardholders`,
    net.income = `Total.Operating.Revenues` - `Total.Operating.Expenditures`
  )

knitr::kable(head(rev_exp_cardholders, 5))
```

Library	Year	City	Library.Service.Type	X..of.Active.Library.Cardholders	Total.Operating.Revenues	Total.Operating.Expenditures	rev.c
Addington Highlands Twp	2006	Flinton	Public or Union Library	715	81375	81556	
Adjala-TosorontioTwp	2006	Alliston	Contracting Municipality	0	41305	41305	
Admaston - Bromley Public Library	2006	Douglas	Public or Union Library	480	26113	17432	
Ajax	2006	Ajax	Public or Union Library	55146	2889854	2918300	
Alderville FN	2006	Roseneath	First Nations Library	126	36751	36751	

Clean columns with infinite and NaN values

```
rev_exp_cardholders<-rev_exp_cardholders%>%
  mutate(
    rev.cardholders=ifelse(is.infinite(rev.cardholders),0,`rev.cardholders`),
    exp.cardholders=ifelse(is.infinite(exp.cardholders),0,`exp.cardholders`),
    net.income=ifelse(is.nan(net.income),0,`net.income`)
  )

knitr::kable(head(rev_exp_cardholders, 5))
```

Library	Year	City	Library.Service.Type	X..of.Active.Library.Cardholders	Total.Operating.Revenues	Total.Operating.Expenditures	rev.c
Addington Highlands Twp	2006	Flinton	Public or Union Library	715	81375	81556	
Adjala-TosorontioTwp	2006	Alliston	Contracting Municipality	0	41305	41305	
Admaston - Bromley Public Library	2006	Douglas	Public or Union Library	480	26113	17432	
Ajax	2006	Ajax	Public or Union Library	55146	2889854	2918300	
Alderville FN	2006	Roseneath	First Nations Library	126	36751	36751	

Insight 1

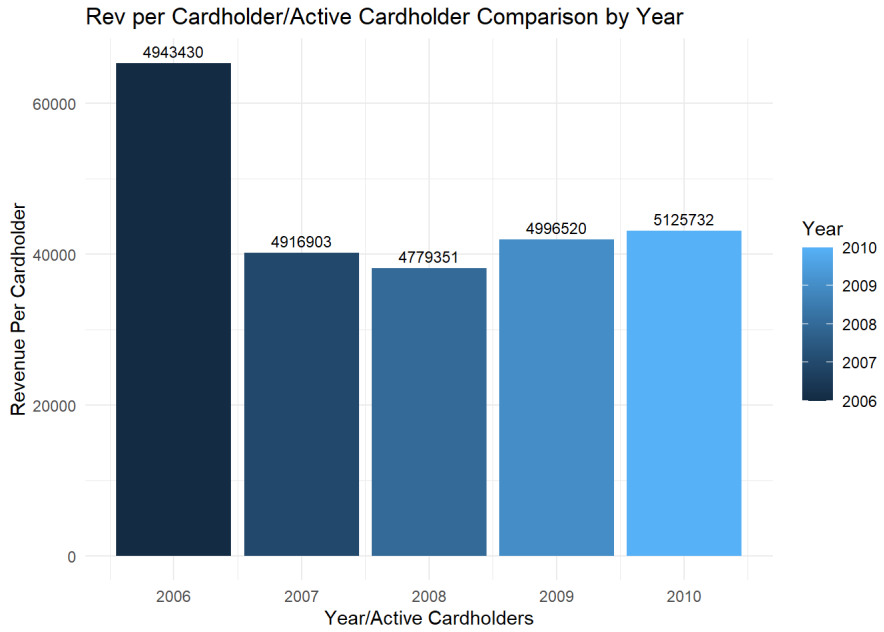
Comparison of revenue per Cardholder and active cardholders by year

```
data_rev6<-rev_exp_cardholders%>%
  aggregate(cbind(X..of.Active.Library.Cardholders, rev.cardholders) ~Year,
            data = ., sum)
data_rev6<-data_rev6%>%
  arrange(desc(rev.cardholders))
knitr::kable(data_rev6)
```

Year	X..of.Active.Library.Cardholders	rev.cardholders
2006	4943430	65351.27
2010	5125732	43048.25
2009	4996520	41934.30
2007	4916903	40201.36
2008	4779351	38102.47

Graphical illustration

```
ggplot(data_rev6, aes(x = `Year`, y = `rev.cardholders`, fill = `Year`)) +
  geom_bar(stat = "identity") +
  geom_text(aes(label = X..of.Active.Library.Cardholders), vjust = -0.5, color = "black", size = 3) +
  labs(title = "Rev per Cardholder/Active Cardholder Comparison by Year",
       x = "Year/Active Cardholders",
       y = "Revenue Per Cardholder") +
  theme_minimal()
```



Explanation: The income generated from cardholders has fluctuated over the years, reaching its peak in 2006. Despite an increase in the number of cardholders between 2006 and 2010, the revenue declined.

Insight 2

Comparison of revenue per Cardholder, expenditure per cardholder and active cardholders by year

```
data_rev<-aggregate(cbind(X..of.Active.Library.Cardholders, rev.cardholders,exp.cardholders) ~Year,
  data = rev_exp_cardholders, sum)
data_rev<-data_rev%>%
  arrange(desc(rev.cardholders))
knitr::kable(data_rev)
```

Year	X..of.Active.Library.Cardholders	rev.cardholders	exp.cardholders
2006	4943430	65351.27	72250.69
2010	5125732	43048.25	44917.38

Year	X..of.Active.Library.Cardholders	rev.cardholders	exp.cardholders
2009	4996520	41934.30	41068.31
2007	4916903	40201.36	43773.39
2008	4779351	38102.47	39392.38

Explanation: Despite experiencing a larger number of active cardholders, the revenue per cardholder shows a fluctuations over the years; however, expenses per cardholder in 2009 was lower compared to other years. This suggests that there may have been better control over costs, or changes in the services provided by the library.

Insight 3

Comparison of revenue per Cardholder, expenditure per cardholder and active cardholders by Library Service Type.

```
data_rev2<-rev_exp_cardholders%>%
  aggregate(cbind(X..of.Active.Library.Cardholders, rev.cardholders,exp.cardholders) ~Library.Service.Type,
  data = ., sum)%>%
  arrange(desc(rev.cardholders))
knitr::kable(data_rev2)
```

Library.Service.Type	X..of.Active.Library.Cardholders	rev.cardholders	exp.cardholders
Public or Union Library	23498344	124484.043	123611.699
First Nations Library	77328	84246.247	97305.063
County, County co-operative or Regional Municipality Library	1180786	18610.496	18555.957
LSB Library	5478	1296.871	1929.433
Contracting LSB	0	0.000	0.000
Contracting Municipality	0	0.000	0.000

Explanation: The First Nations Library have a smaller number of active cardholders when compared to the Public or Union Library, but it manages to generate significant revenue.

Insight 4

Comparison of revenue per Cardholder, expenditure per cardholder and active cardholders by Library Name

```
data_rev3<-rev_exp_cardholders%>%
  aggregate(cbind(X..of.Active.Library.Cardholders, rev.cardholders,exp.cardholders) ~Library,
  data = ., sum)%>%
  arrange(desc(rev.cardholders))%>%
head(n=5)
knitr::kable(data_rev3)
```

Library	X..of.Active.Library.Cardholders	rev.cardholders	exp.cardholders
Sheshegwaning FN	391	27186.660	27842.772
Simcoe County Co-operative	1364	9744.027	9744.027
Magnetawan FN	152	3654.367	3429.711
Seine River FN	272	3188.272	3344.784
Michipicoten FN	316	3174.515	3295.594

Explanation: Sheshegwaning FN has the highest expenses while Michipicoten FN has the lowest.

Insight 5

Net income comparison by Library Service Type

```
data_rev4<-rev_exp_cardholders%>%
  aggregate(cbind(X..of.Active.Library.Cardholders, rev.cardholders, Total.Operating.Revenues, net.income) ~Library.Service.
Type,
  data=., sum)%>%
  arrange(desc(net.income))
knitr::kable(data_rev4)
```

Library.Service.Type	X..of.Active.Library.Cardholders	rev.cardholders	Total.Operating.Revenues	net.income
County, County co-operative or Regional Municipality Library	1180786	18610.496	164773801	217115
Contracting LSB	0	0.000	123343	-36722
LSB Library	5478	1296.871	180154	-71296
Contracting Municipality	0	0.000	6391475	-258055
First Nations Library	77328	84246.247	12945532	-1029946
Public or Union Library	23498344	124484.043	2729940478	-4942833

Explanation: The magnitude of net loss shows that Public Library has most significant losses and County being the only Library Service Type with a positive net profit. It is important to investigate why Contracting LSB and Contracting Municipal had zero active cardholders and received revenue with a record of loss.

Insight 6

Profit comparison by Library Name - top 10 and bottom 10

```
data_rev5<-rev_exp_cardholders%>%
  aggregate(cbind(X..of.Active.Library.Cardholders, rev.cardholders, exp.cardholders, net.income) ~Library,
            data = ., sum)%>%
 arrange(desc(net.income))%>%
   slice(c(1:10, (n()-9): n()))
knitr::kable(data_rev5)
```

Library	X..of.Active.Library.Cardholders	rev.cardholders	exp.cardholders	net.income
Oshawa	288910	767.3607	739.2852	1804167
London	779745	601.2155	589.9551	1763669
Vaughan	705867	379.3132	370.2166	1144594
Clarence-Rockland	31994	507.2113	400.4888	1031477
Windsor	507022	445.1123	438.0762	749718
Ottawa	1253703	729.3369	726.4052	709201
Stormont, Dundas & Glengarry County	51374	1138.5538	1055.6690	677808
St. Catharines	403815	323.6087	315.1372	676229
Stratford	57930	903.6937	848.4852	628272
Essex County	183702	613.0137	597.5668	567349
Iroquois Falls	5761	760.5224	1320.2549	-630000
Bruce County	100160	741.7273	780.7389	-652695
Peterborough	127807	452.6908	487.1668	-925844
Fauquier-Strickland Twp	2344	646.0632	2630.4182	-940133
Lambton County	171042	757.3473	787.5061	-1011510
Thunder Bay	149834	915.9713	965.0335	-1228406
Brampton	771270	424.5005	440.7550	-2438093
Toronto	4571034	995.3766	997.8839	-2733436
Oakville	376579	572.6231	611.8314	-2839643
Mississauga	1131767	532.5147	573.7264	-9079948

Explanation: In relation to profit maximization, Oshawa Library made the highest profit per cardholder, while Mississauga Library made a loss and on the bottom of the list.

Recommendation to Ontario Government:

1. Examine the factors that led to the highest revenue in 2006, despite there being fewer cardholders in 2006 compared to subsequent years. It is important to determine if it was a strategic decision or an influence by external factors.
2. Despite having a smaller user base, the “First Nations Library” has managed to generate significant revenues. A study into the revenue generation strategies employed by this library could shed light on alternative funding models that can sustain smaller libraries.

3. Further investigate factors contributing to the increase in the number of cardholders in County, County co-operative, or Regional Municipality Library and analysis of the strategies implemented to drive user growth.
4. Determine the causes of net losses in larger libraries, particularly the Public or Union Library. Also, Understand the circumstances surrounding net losses in smaller libraries to identify the challenges they are currently encountering for potential solutions.
5. Re-evaluate the policy guiding the revenue sharing across all libraries to ensure optimum performance.