1. The Experience Library - 9/10

2. Availability 1 - 9/17

3. Availability 2 - 10/1

4. Discovery - 10/8

5. Concentration - 10/22

6. Selection - 10/29
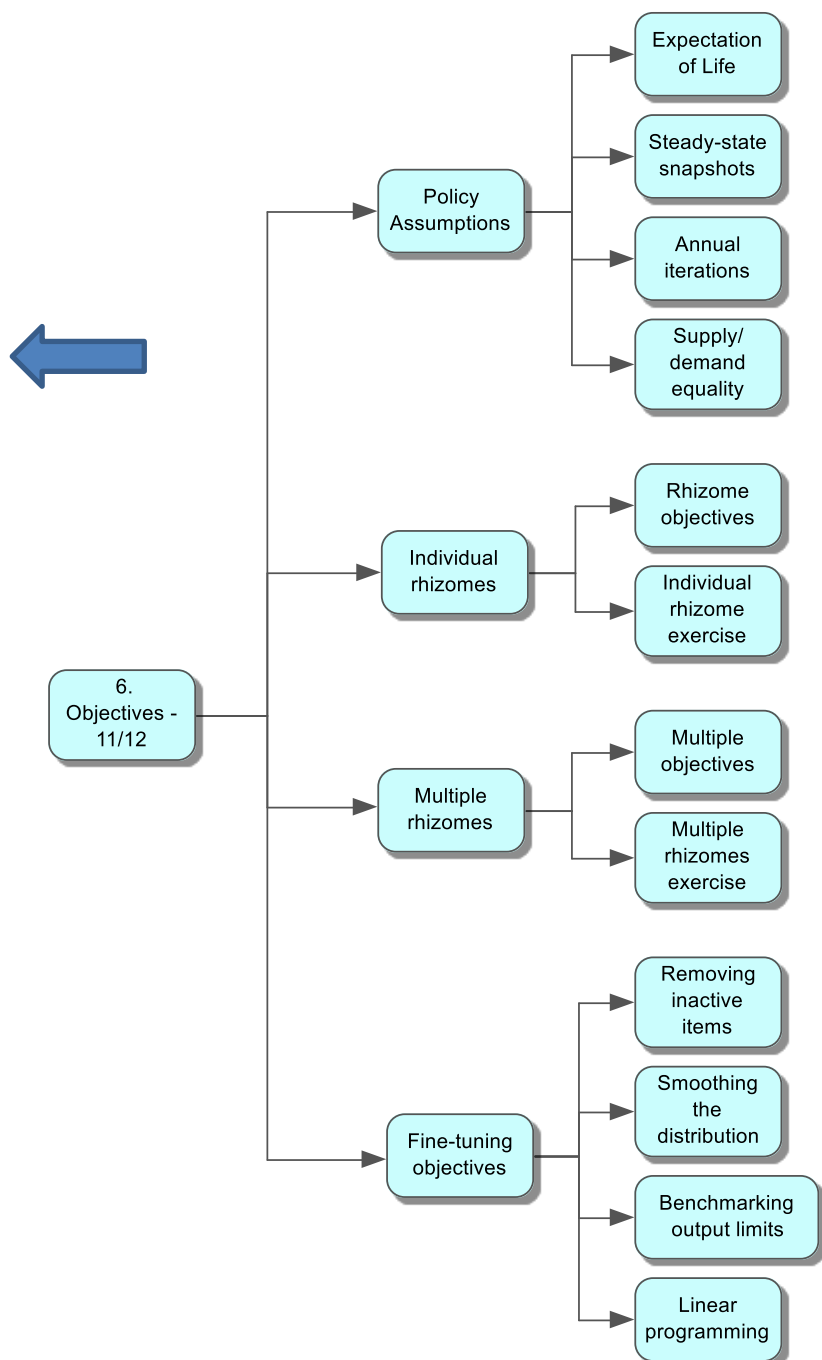
7. Objectives - 11/12

8. Plan/Do/Check/Act - 11/19

Objectives

November 12, 2013
Waterloo Public Library

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6. Objectives - 11/12

Policy Assumptions
- Expectation of Life
- Steady-state snapshots
- Annual iterations
- Supply/demand equality

Individual rhizomes
- Rhizome objectives
- Individual rhizome exercise

Multiple rhizomes
- Multiple objectives
- Multiple rhizomes exercise

Fine-tuning objectives
- Removing inactive items
- Smoothing the distribution
- Benchmarking output limits
- Linear programming

Terms

Actual frustration rate: The percentage of demand that was not met in the rhizome, calculated by dividing *Frustrated readers* by *Total demand*. The Actual frustration rate is the reciprocal of *Reader availability*.

Adds: The annual number of holdings added to a rhizome from budgeted funds, including new publications, replacements, and new editions, but not including gifts or other additions which are not part of the rhizome budget. See also *Demand adds, Final adds. Maximum adds*, *Minimum adds*, *Set adds*, *Steady state adds*, *Target adds*.

Adds maximum: A *Limit* on the maximum number of holdings to add annually to each rhizome, set as a percentage increase of the *Target adds*. This limit helps to optimize the cost effectiveness of budget expenditures while maintaining a base level of availability for all rhizomes. See also the broader term *Adds*.

Adds minimum: A *Limit* on the minimum number of holdings to add annually to each rhizome, set as a percentage decrease of the *Target adds*. This limit helps to optimize the cost effectiveness of budget expenditures while maintaining a base level of availability for all rhizomes. See also the broader term *Adds*.

Audience: A rhizome defined through direct demographic characteristics of its readers. Common audiences include Adult, Young Adult, Preschool, and Children. See also *Rhizome*.

Availability: A measure of collection performance based on the ratio of successful searches to the total searches made by readers: the percentage of readers who find texts that satisfy their purpose for using the collection. See *Random availability*; *Reader availability*.

Average out: The annual average (mean) number of holdings that are active but unavailable because of current reader use. This is calculated by taking a monthly snapshot of the status of the items in the collection and then calculating the annual mean of the items with the status of "checked out," "on hold," or "in transit" from the snapshot. Do not include items that are not currently active, such as those that have been permanently set to "lost," "missing," or "damaged."

Average holdings: Average (mean) number of holdings for a rhizome over the fiscal year. If the number of holdings is stable, calculate the mean of the number of holdings at the beginning and end of the fiscal year. If the size of the rhizome has varied more than 5% over the fiscal year, calculate the mean of the monthly holdings reported for the year.

Budget rounded: Values for the *Target budget* rounded to the nearest $10.

Calculated loan length: The mean number of days that items in a rhizome are actually kept on loan, as calculated from the value of mu for the rhizome. See also *mu*.

Calculated mu: The value of mu calculated using loan length estimates based on actual data from the library and rhizome being analyzed.

Calculated mu demand/item: The demand per item calculated using loan length estimates based on actual data from the library and rhizome being analyzed.

Calculated mu total demand: The total demand calculated using loan length estimates based on actual data from the library and rhizome being analyzed.

Circulation: The annual number of items checked out for a rhizome. Use *Original circulation* if possible (annual circulation without renewals). See *Original circulation* for alternatives.

Demand adds: The estimated number of annual additions to a rhizome if a budget were to be based primarily on reader demand. See also the broader term *Adds*.

Demand/item: The average (mean) number of readers who would check out a holding in the rhizome if it were available to them. The formula for calculating demand per item is based on an exponential curve that represents the pattern of demand in library rhizomes. Also referred to as *Per item demand*.

Demand size: The estimated number of holdings for a rhizome based on the reader *Demand/item* for materials in that rhizome.

Estimated mu: The value of mu estimated using the *Standard loan length* from the library and rhizome being analyzed. See also *μ (mu) (Mean return rate)*.

Estimated mu demand/item: The demand per item estimated using the *Standard loan length* from the library and rhizome being analyzed.

Estimated mu total demand: The total demand estimated using the *Standard loan length* from the library and rhizome being analyzed.

Expectation of life formula: A formula borrowed from actuarial science that relates average life expectancy, population size, and the rate of entry into a population: life expectancy in years equals population size divided by the number of entrants per year. The formula assumes a stable population over time. It underlies the relationships between collection size, acquisition rates, and median age that are the foundation of the budget model. See *Steady state collection*.

$$Average\ Life\ Expectancy = \frac{Population\ Size}{Entrants\ per\ Time\ Unit}$$

$$Age = \frac{Size}{Adds}$$

Expected frustration rate: The average (mean) percentage of frustration we would theoretically expect given the size of the rhizome and the circulation, assuming that circulation of particular holdings is random—which it is not. Expected frustration rate is equal to the percentage of holdings out at a given time; it is the reciprocal of *Random availability*. It is compared to the *Actual frustration rate* to determine the *Vitality* of the collection. See *Actual frustration rate*, *Average out*, *Vitality, Random availability*.

Final adds: The number of holdings to add for a rhizome used to calculate the final *Target budget*. This value includes all adjustments for policy and demand factors that are applied in the budget model. See also the broader term *Adds*.

Frustrated readers: Roughly, an estimate of the number of readers who didn't find what they would have liked to find; the number of holdings that people did not check out, but would have if they had found them on the shelf. Estimated by subtracting *Original circulation* for a rhizome by the *Total demand* for the rhizome.

Holdings: Average (mean) number of holdings for a rhizome over the fiscal year; also referred to as the number of items or volumes in the rhizome. See also *Average holdings*.

Limits: Upper and lower constraints on possible changes in sets of values in the budget model. The model uses *Linear programming* to optimize the values for the number of items and annual adds for each rhizome, with the objective of maximizing the potential circulation of the collection. Limits on size and annual adds for each rhizome are necessary because otherwise, the program would set all items and annual adds to the most cost-effective rhizome in terms of potential circulation, typically DVDs, and zero out all other rhizomes. See *Adds maximum*, *Adds minimum*, *Size maximum*, *Size minimum*.

Linear programming: The mathematical process for optimizing a set of values which is used in the budget model to calculate the target size and target annual additions for a collection. The Excel Solver function is used to complete the actual calculations.

Loan length: 1) The *Standard loan length* in days as stated in library policies: typically 14 or 21 days for books, 7 or less days for videos, and so on: sometimes used to estimate the *calculated loan length*. 2) *Calculated loan length*: the mean number of days that items in a rhizome are actually kept on loan as calculated from the value of mu for the rhizome. See also *mu*.

μ (mu) (Mean return rate): The average (mean) maximum circulation of an item in the rhizome; thus, the theoretical maximum turnover for the rhizome. The value of μ depends on the average length of time readers keep an item out of the library (including any renewals on the item). Combined with the number of circulations for an item or rhizome and tables of the expected values for particular turnover rates, it helps to measure the amount of time items are not available to other readers. See also *Estimated mu*.

Median age: A measure of the average (median) age of a rhizome: the number of years at which one half of the holdings in the rhizome are older and one half are younger. Use median age rather than mean age because using the median accounts for the effect of very old outliers that are held in most rhizomes. You may measure the median from the add date or copyright date of holdings. In general measuring from the add date is preferable because it gives better insight into rhizomes such as picture books with many older copyright dates but high replacement needs. See also *Target median age*.

Net change: The estimated annual change in the number of holdings for a rhizome for each year until the *Target size* is reached. Calculated

by adding together the *Target adds* and *Target weeds* (which may be negative values). See also *Set years to target*.

Original circulation: Annual circulation without renewals. If these data are not available directly, sample the percentage of renewals for each rhizome to obtain a correction factor to apply to the reported circulation. Circulation reported with renewals may be used, but the demand estimates will be higher than actual demand.

Per item cost: The average (mean) actual cost per holding added to a rhizome in the last fiscal year, including discounts.

Per item demand: The average (mean) number of readers who would check out a holding in the rhizome if it were available to them. The formula for calculating demand per item is based on an exponential curve that represents the pattern of demand in library rhizomes. Also referred to as *Demand/Item*.

% Replaced: The percentage of items in a rhizome which must be discarded and replaced annually to maintain a *Steady state collection*. Together with items to be discarded to meet any target size reductions, these replacements equal the annual *Target weeds* for the rhizome.

Potential circulation: The maximum possible circulation for a rhizome or total collection if all reader requests were satisfied. The *Linear programming* approach used in the budget model optimizes the rhizome size and annual adds so that potential circulation is maximized within the limits set by the library. In the budget model, potential circulation is limited to reflect local selection practices by adjusting it to reflect the existing turnover for each rhizome.

Random availability: The percentage of holdings that we would expect to be on the shelf for a particular rhizome if circulation were distributed randomly over the rhizome—which it is not. Random availability is equal to the

average percentage of items in a rhizome that are on the shelf rather than checked out. It is calculated by subtracting *Average out* from the *Total holdings* for the collection, and then dividing the result by the *Total holdings*. See *Average out*, *Total holdings.*

Reader: a person who uses the collections and services of a library. Used here instead of more common terms such as "user," "patron," "borrower," or "customer." "Reader" is more evocative of the underlying public purpose of the library and the manner in which people experience it. The use of the term does not exclude texts in the library which are experienced by "listeners" or "viewers." There is a transformative sense in which texts in all formats are "read" by those who experience them, and it is this learning experience which underlies the designation of people who visit libraries physically or electronically as "readers."

Reader availability: The mean success rate for the rhizome, calculated by dividing *Original circulations* by *Total demand*. Generally, the proportion of holdings that readers are interested in that are on the shelf when readers use the library. Reader availability can also be estimated from surveys by asking readers how successful they were in finding what they wanted, but typically these surveys do not yield results at a subject or topic level. Reader availability in public libraries averages about .65. See also *Random availability; Reader availability*.

Rhizome: A group of library materials for which budget projections and line items are desired. Rhizomes are defined by the features that readers use to categorize library materials: authors, series, topics, genres, academic subjects, formats, or any other useful characteristic.

Set adds: A value for the exact number of holdings to add to a rhizome annually, set by the library for rhizomes for which policy considerations override the value arrived at through the optimization formulas. Such considerations might include building up or winding down a rhizome, accounting for extraneous demand factors, accounting for extensive gift additions or externally funded purchases, and supporting policy or planning goals. See also the broader term *Adds*.

Set size: A value for the exact number of holdings for a rhizome, set by the library for rhizomes for which policy considerations override the value arrived at through the optimization formulas. Such considerations might include building up or winding down a rhizome, accounting for extraneous demand factors, and supporting policy or planning goals.

Set years to target: A value for the exact number of years over which a rhizome will reach its target value, set by the library for rhizomes for which policy considerations override the general value set for most rhizomes. Such an exception will ordinarily be made for rhizomes in which the size is being built up or eliminated at a faster rate than the other rhizomes in the collection.

Size maximum: A *Limit* on the minimum number of holdings for a rhizome, set as a percentage decrease of the *Target size*. This limit helps to optimize the cost effectiveness of budget expenditures while maintaining a base level of availability for all rhizomes.

Size minimum: A *Limit* on the maximum number of holdings for a rhizome, set as a percentage increase of the *Target size*. This limit helps to optimize the cost effectiveness of budget expenditures while maintaining a base level of availability for all rhizomes.

Standard loan length: The loan length in days as stated in library policies: typically 14 or 21 days for books, 7 or less days for videos, and so on: sometimes used to estimate the *calculated loan length*.

Steady state adds: An interim value which represents the number of holdings to be added to a rhizome annually to maintain a *Steady state collection*, based on the *Target size* and *Target median age* that the library sets for the each rhizome. See also the broader term *Adds*.

Steady state collection: A collection or rhizome whose total number of items remains constant over time. The budget model uses a mathematical formula that assumes optimal target sizes and ages for a collection and its component rhizomes (the *Expectation of life formula*). One use of these size and age values is to define a steady state collection size. In the model, they are used as technical planning devices for setting annual target size and replacement values that are subject to revision as reader demand, library resources, publication rates, and collection performance change over time.

Target adds: An interim value which represents the number of holdings to be added to a rhizome annually to account for any growth or reduction in collection size based on the *Target size* for each rhizome, while also maintaining a *Steady state collection*. Calculated by adding *Demand adds* and *Steady state adds*. See also the broader term *Adds*.

Target budget: The final line item budget amount for each rhizome, calculated after all size, age, material costs, and total budget constraints have been accounted for in the model. The target budget represents the allocation of funds that will yield the highest potential circulation within the constraints adopted in the budget model.

Target median age: The specific *Median age* set as a goal for each rhizome.

Target size: The specific number of items set as a goal for each rhizome. The target size is set to maximize *Potential circulation* within the size limitations set for a rhizome.

Target weeds: The estimated annual number of items to weed in a rhizome to maintain its steady state size and age, including any targeted growth or reduction in size. Calculated by combining the annual replacements required to maintain a steady state collection (*Steady state adds*) and any weeds (minus values) in the *Demand adds* for the rhizome.

Total demand: The number of holdings times the demand per holding. This represents the maximum number of circulations which could be expected if every patron found on the shelf, and proceeded to check out, every holding that we could expect him or her to be interested in. Actual circulation is of course lower, because in a circulating collection other people have the items part of the time, so they cannot be found on the shelf. This effect is magnified because the items patrons have out are also the items other patrons are most likely to be looking for.

Turnover: The average circulation per holding (item in the rhizome).

Vitality: A measure which indicates how evenly demand (and consequently, circulation) is spread over the holdings in a rhizome, calculated by dividing the *Expected frustration rate* by the *Actual frustration rate.* The expected value is 1.0. If vitality is significantly lower than 1.0 (around .75 or less), the rhizome probably contains a number of items which receive proportionately little use and might be weeded. If the vitality is significantly higher than 1.0 (above 1.25 or more), the rhizome size is probably too small to support the demand.

Years to target: The number of years set in the model to reach the target size of each rhizome.

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Rhizome Objectives

Size	**Number of items** *Policy decision*	
Median age	**Years** *Policy decision*	
Annual adds	**Number of items** *Rhizome size ÷ (Median age × 2)*	
Average title cost	**Dollars** *Estimated from previous year*	
Annual cost	**Dollars** *Annual acquisitions × Average title cost*	
Annual circulation	**Transactions** *Estimated from previous year*	
Annual turnover	**Ratio** *Annual circulation ÷ Rhizome size*	
Maximum annual demand	**Transactions** *Demand per item [Lookup Table] × Size*	
Maximum size	**Number of items** *Maximum demand ÷ Annual turnover*	
Maximum annual adds	**Number of items** *Maximum size ÷ (Median age × 2)*	
Maximum annual cost	**Dollars** *Maximum annual adds × Average title cost*	

Base Data

Rhizome	1. Number of Items	2. Original Circulation	3. Turnover #2 ÷ #1	.4. Loan Period	5. Demand per item *Table*	6. Maximum Demand #5 × #1
Mysteries	1,465	5,239		3 weeks		
Science Fiction	207	486		3 weeks		
General Fiction	1,279	3,336		3 weeks		
Adult Nonfiction	5,023	10,548		3 weeks		
Large Print	849	1,375		3 weeks		
Beginning Readers	1,839	12,482		3 weeks		
Juvenile Fiction	3,348	10,912		3 weeks		
Juvenile Nonfiction	2,804	6,721		3 weeks		
YA Fiction	1,716	3,941		3 weeks		
Total	18,530	55,040	n.a.	n.a.	n.a.	

Objectives (Fully funded collection)

Rhizome	7. Maximum Size #6 ÷ #3	8. Median Age	9. Annual Acquisitions #7 ÷ (#8 × 2)	10. Average Title Cost	11. Annual Cost #9 × #10
Mysteries		6		$12	
Science Fiction		6		$12	
General Fiction		7		$15	
Adult Nonfiction		8		$18	
Large Print		8		$17	
Beginning Readers		6		$10	
Juvenile Fiction		7		$12	
Juvenile Nonfiction		6		$13	
YA Fiction		5		$12	
Total		n.a.		n.a.	

Base Data

Rhizome	1. Number of Items	2. Original Circulation	3. Turnover #2 ÷ #1	.4. Loan Period	5. Demand per item *Table*	6. Maximum Demand #5 × #1
Total			n.a.	n.a.	n.a.	

Objectives (Fully funded collection)

Rhizome	7. Maximum Size #6 ÷ #3	8. Median Age	9. Annual Acquisitions #7 ÷ (#8 × 2)	10. Average Title Cost	11. Annual Cost #9 × #10
Total		n.a.		n.a.	

Base Data

Rhizome	1. Number of Items	2. Original Circulation	3. Turnover #2 ÷ #1	.4. Loan Period	5. Demand per item *Table*	6. Maximum Demand #5 × #1
Total			n.a.	n.a.	n.a.	

Objectives (Fully funded collection)

Rhizome	7. Maximum Size #6 ÷ #3	8. Median Age	9. Annual Acquisitions #7 ÷ (#8 × 2)	10. Average Title Cost	11. Annual Cost #9 × #10
Total		n.a.		n.a.	