PUGH METHOD EXAMPLE
IMPROVED KITCHEN LIGHTING

SOURCE: Edward Lumsdaine and Martin Binks
Entrepreneurship from Creativity to Innovation, Trafford Publishing, 2007
www.InnovationToday.biz

The example has been developed by Monika Lumsdaine.
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Problem Briefing

A large kitchen (15 ft long and 9-1/2 ft wide) in a house built in the late 1940s is quite dark at night, especially at the sink and the chopping board in front of the centrally located window. The slightly sloped cherry-paneled ceiling has an average height of 10 ft 9 in. and is traversed by a 14 in. by 6-in. wood-laminate beam supporting the flat roof immediately above. The walls are painted beige; the cabinets are metal—beige above the counter, brick red below. The countertop is beige, and the vinyl floor has a brown brick pattern. Table 1 lists the existing lighting fixtures. The fluorescent tubes lying on top of the cabinets are plugged into outlets above the cabinets (all on the same circuit) with switch at the kitchen entrances. All other fixtures are on individual switches. The spotlights over the sink are ugly and off target. The chrome triangular under-cabinet fixtures are quaint but have only a dim light output. All five plugged-in fluorescent tubes look cheap and are hard to clean, and the 2-ft tube is rarely if ever used.

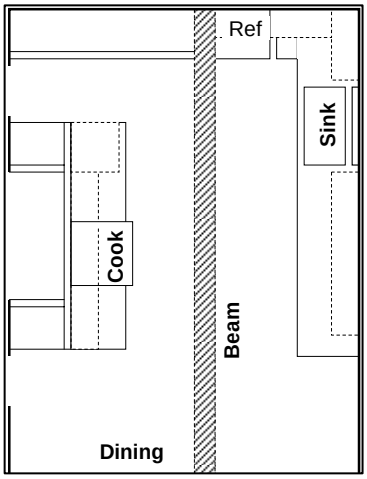


Table 1 *Existing Kitchen Light Fixture Schedule*

I.D.	*Quantity*	*Rating*	*Type Fixture*	*Location*
A	4	20 watt	2-ft fluorescent triangular	Under wall cabinets
B	4	40 watt	4-ft fluorescent tubes	On top of cabinets
C	2	75 watt	Incandescent spot in can	5 ft above sink
D	1	20 watt	2-ft fluorescent tube	Under microwave

Problem Definition Statement

Improve the general and task lighting in the kitchen shown on the sketch, while upgrading the lamp quality and matching or complementing the style of the lighting fixtures in the adjacent dining and living rooms, at reasonable cost and without remodeling the kitchen or covering up the beauty of the existing paneled ceiling.

Round 1 Concepts, Performance Criteria and Evaluation

The concepts for improving the lighting in this kitchen are listed in Table 2. The criteria are listed in the Round 1 matrix shown in Table 3. The current lighting is taken as the datum. None of the options provide a standout solution for solving the problem. However, the evaluation makes it clear that a second meeting with the lighting supplier is necessary to explore further options and get more information. In addition, some of the criteria will need to be expanded and made more specific.

Table 2 *Options for Round 1 of the Kitchen Lighting Evaluation*

1. **Track Lighting**—Install an 8-ft long track with 4 movable spots (250 watts each, black), to match existing track light in adjacent living room. Plug into outlet over cabinet near sink.
2. **Sink Task Lighting**—Replace the two spotlights over the sink with nicer-looking, more efficient, practical lamps.
3. **Over-Cabinet Strip Lighting**—Replace fluorescent tubes B with lighted strip along top of all wall cabinets.
4. **Fluorescent Hanging Fixtures**—Install two 4-ft fluorescent fixtures with efficient diffusers at 8-ft level (on chains, with wood surrounds) to replace tubes B; wire to main switch. Option explored with supplier.
5. **Halogen Fixtures**—Install two hanging halogen down-lights; wire to main switch; match chrome style of under-cabinet triangular fixtures. Option explored with supplier.
6. **Brighter Surfaces**—Paint walls white; install white vinyl flooring; install new white countertops; paint cherry panels in ceiling white.

Table 3 *Round 1 Evaluation of Kitchen Lighting Options*

Criteria	Concepts:	Now	1	2	3	4	5	6
1. Adequate sink task light			S	+	—	+	+	—
2. Other countertop lighting			—	S	—	+	+	—
3. General lighting		D	S	S	S	+	+	+
4. Light to ceiling		A	—	S	+	—	—	+
5. Energy efficient		T	—	+	—	+	+	+
6. Easy to clean		U	+	S	S	S	+	—
7. Easy bulb replacement		M	+	S	—	S	+	S
8. Allow deletion of tubes			—	—	+	—	—	—
9. Matching room styles			+	+	—	—	—	S
10. Attractive high-tech look			+	+	+	+	+	S
11. Low labor cost			—	+	+	—	—	—
12. Low materials cost			—	—	—	—	—	—
TOTAL POSITIVES (+)			**4**	**5**	**4**	**5**	**7**	**3**
TOTAL NEGATIVES (—)			**6**	**2**	**6**	**5**	**5**	**6**

Round 2 Concepts and Evaluation

Option #5—the halogen fixture—becomes the new datum for Round 2 since it had the highest number of positives. The aim for Round 2 is to try and combine concepts to eliminate negatives and supply more detail. These concepts are listed in Table 4. The painting option is deleted as too costly, time-consuming and not easily reversible. The Round 2 matrix is shown in Table 5. Note that in this table, S is also used to indicate neutral or not applicable.

Table 4 *Options for Round 2 of the Kitchen Lighting Evaluation*

7. **Fluorescent Track Lighting**—Install a black 8-ft long, 2-circuit track with 3 movable cans (150 watts incandescent bulbs or fluorescent bulb option) and one 2-ft fluorescent, 40-watt movable parabolic louvered diffuser ("wall washer") to match existing track light in adjacent living room. Mount to bottom of beam; connect to main switches with conduit along beam and ceiling edge.
8. **Sink Task Lighting**—Replace the two spotlights over the sink with black cans matching the track light of Option #1. Use fluorescent bulbs.
9. **Over-Cabinet Strip Lighting**—Replace the fluorescent tubes with a rope light along the top of all wall cabinets.
10. **Fluorescent Hanging Fixtures**—Install two 4-ft fluorescent fixtures with efficient diffusers at 8-ft level (sleek high-tech design); hang from ceiling, centered between counters.
11. **Halogen Fixtures**—Install two hanging halogen down lights; wire to main switch; match style of dining room chandelier if possible.

Table 5 *Round 2 Evaluation of Kitchen Lighting Options*

Criteria	Concepts:	5	7	8	9	10	11
1. Adequate sink task light			S	+	—	S	S
2. Countertop lighting (window wall)			+	+	—	S	S
3. Countertop lighting (cook-top wall)		D	—	—	—	S	S
4. Light to ceiling		A	S	S	+	S	S
5. Low-energy night lighting		T	S	+	+	S	S
6. Low glare		U	+	+	+	+	S
7. Flexible (direction, additions, lumens)		M	+	+	—	S	S
8. Easy bulb replacement			S	S	—	—	S
9. Energy efficient			S	S	—	S	S
10. Easy to clean			S	S	—	S	S
11. Preserves view of ceiling/open space			S	+	+	—	S
12. Allow deletion of tubes			+	—	+	S	S
13. Matching room styles			+	+	S	—	+
14. Attractive to future owners			+	+	—	—	S
15. Low labor cost			S	+	+	S	S
16. Low materials cost			—	+	—	+	S
TOTAL POSITIVES (+)			**6**	**10**	**6**	**2**	**1**

Since Concept #11 has no negatives, does this mean it is the optimum solution? No—as you will see, it will rank very differently when evaluated against the new datum. The over-the-counter strip-lighting option is now eliminated as not being cost effective; the fluorescent hanging fixture is eliminated because it is too intrusive.

Round 3 Concepts and Evaluation

Concept #8 had the highest number of positives and is chosen as the datum for Round 3. Concepts #7 and #8 are combined as Concept #12 (see Table 6). This allows for even lighting of both kitchen sidewalls with an additional "wall washer." Concept #11 is carried forward unchanged. The Round 3 matrix is shown in Table 7.

Table 6 *Options for Round 3 of the Kitchen Lighting Evaluation*

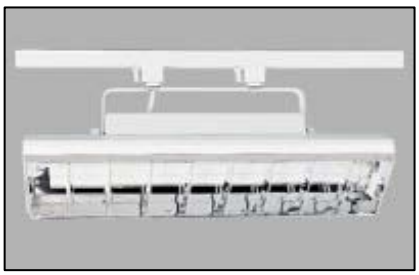
11. **Two Halogen Fixtures**—Install two hanging halogen down lights; wire to main switch. Match the style of the glass shades with the style of the dining room chandelier if possible.
12. **Fluorescent Track Lighting System**—Install a black 8-ft long, 2-circuit track with *two* movable cans with fluorescent bulbs and *two* 2-ft fluorescent, 40-watt movable parabolic louvered diffusers (wall washers). Mount to bottom of beam; connect to main switches with conduit along beam/ceiling edge. Replace the two spotlights over the sink with matching cans and fluorescent bulbs to achieve a flexible, attractive, and easily modified, adjustable lighting system—matching the track lighting in the adjacent living room.

Table 7 *Round 3 Evaluation of Kitchen Lighting Options*

	Criteria	Concepts:	8	11	12
1.	Adequate sink task light			—	+
2.	Countertop lighting (along window wall)			—	+
3.	Countertop lighting (along cook-top wall)			—	+
4.	Indirect light to ceiling (eliminate "cave" look)		D	S	+
5.	Low-energy night lighting		A	—	+
6.	Low glare, especially for eyeglass wearers		T	—	+
7.	Flexibility in direction, light level, future additions		U	—	+
8.	Easy bulb replacement (with step stool, not ladder)		M	S	S
9.	Energy efficient, cool burning			—	S
10.	Sun-type light quality			+	+
11.	Easy to clean off kitchen grease buildup			S	S
12.	Preserves view of beautiful paneled ceiling			—	S
13.	Allows deletion of all existing plugged-in tubes			—	+
14.	Matching adjoining dining and living room fixtures			S	S
15.	Attractive to future owners; good "selling point"			—	+
16.	Reasonable installation costs			S	S
17.	Material cost in line with "value added"			S	S
	TOTAL POSITIVES (+)			**1**	**10**
	TOTAL NEGATIVES (—)			**10**	**0**

Best Solution and Concluding Comments on the Process

The concept that ultimately was incorporated into the best solution was generated for Round 2 by combining the track lighting and fluorescent bulb concept. The supplier suggested this option, and the owner was able to see such an installation in a store nearby. Combining the track lighting and the over-the-sink fixture into a matching system optimized the solution, and the merits of this solution are confirmed by the Round 3 evaluation.



Wall Washer

This solution solves the original problem, with added value. A strong selling point is the built-in flexibility which easily allows future modifications as well as on-site adjustments after installation, depending on changing needs. With this solution, the over-the-cabinet 4-foot long fluorescent tubes were eliminated, since the 2-foot fluorescent "wall washers" provide very bright but diffused light. The total cost of $742 was acceptable, since the system is highly functional as well as attractive. The Pugh method was crucial for clarifying criteria, generating viable options and identifying the optimal solution. The homeowners are happy with the new lighting system.

An individual, not a team, conducted this application of the Pugh method for evaluating different options and developing a best solution. It illustrates that this evaluation technique can be used profitably by anyone, as long as the evaluator maintains an unbiased viewpoint when judging each concept and obtains information and ideas from experts as needed for developing good alternatives, as shown in this example.